

REPORT
OF THE
MEDICAL SERVICES, MINISTRY OF HEALTH
SUDAN GOVERNMENT

OOO



FOR THE YEAR

1954-55



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CHAPTER I.

INTRODUCTION.

The year under review carried with it great historical events in the country as a whole and this Ministry had its share. With the Sudanisation of the posts of the Director and Deputy Director early in this period the whole medical and administrative policy for the first time was planned and executed by Sudanese.

Other Senior posts which have been sudanised were those of Controller Medical Stores, Principal Matron, her Assistant, Principal Health Visitor School and two Senior Nursing Officers.

The resignations of many British personnel in the medical, laboratory, and Public Health fields created a vacuum which at one time appeared to seriously threaten the machinery of the Organization. Twelve out of 65 British officials remained and the rest resigned in a short space of time. However it was not only possible to discharge the normal day to day duties, but certain outbreaks were successfully combatted and research work and surveys on various endemic diseases were carried out which made available valuable data and information for future campaign.

A further progress in Anti tuberculosis work was achieved by the establishment of a Rehabilitation centre in Khartoum.

It was possible to recruit more General Duty Doctors, few nurses and Specialists to fill posts that fell vacant by resignations. In spite of frequent changes of stations amongst staff that took place on personal reasons the work of Hospitals went unhampered.

The Small-pox outbreak of last year continued in Bahr El Ghazal and sporadic cases were encountered in Equatoria and Darfur. Cerebrospinal meningitis reached epidemic proportions in Bahr El Ghazal and Upper Nile and Sleeping Sickness flared up in Equatoria at Yambio and Yei. Sharp localised outbreaks of malaria occurred at Managil and some villages of the White Nile. The raised incidence of enteric fever also persisted in Northern and Blue Nile Provinces.

The most happy event of the year was the admission of the Sudan as an Associate Member of World Health Organisation and the representing member attended the 8th General Assembly at Mexico this year. Not less cheerful is the selection of a Sudanese girl student for the College of nursing at Alexandria. She, on graduation, will return to take charge of the Sudan Nursing College Khartoum which is on the way of creation and will be run until then by staff seconded from W.H.O.

The Sudan was also represented in other international medical occasions. Numbers of experts from W.H.O. and other countries visited the Sudan for advice or study. Certain of our methods in prevention and cure were considered worth studying.

Two important legislations have been enacted during the year. The first was the 1954 Quarantine Bill which came into force in December and by which the Sudan now adopts the International Sanitary Regulations. The second was the bill of the Medical Council that will have power to supervise the Medical profession and medical ethics. By this procedure the Sudan will catch up many civilised countries.

A noticeable and encouraging feature in province reports was the attention given to Rural Sanitation and preventive measures.

Expansions in the curative side were also effected, four new hospitals were added to the list and a number of rural dispensaries and Dressing Stations came into being.

In this crucial year in the History of the Sudan this Ministry has more than held its grounds. The test has been passed and the ease with which it has been overcome gives confidence for a better future.

Post graduate studies for serving doctors continue and there are now two candidates for M.R.C.P., two for D.P.H. and one D.P.H. in U.K.

Four Doctors returned during the year after receiving their qualifications.

Two M.R.C.P. and two D.P.H. from United Kingdom.

CHAPTER II.

ADMINISTRATION.

(a) STAFF AND FUNCTIONS.

Table I. shows the establishment of classified staff. Some categories of professional and technical staff were still under establishment. The table includes officials serving on secondment with local Government authorities.

TABLE I.

CATEGORY	Establishment			
	British	Sudanese	Egypt	Syrians & Others
HEADQUARTERS.				
Director		1		
Deputy Director		1		
Asst. Director (P.H.)		1		
Asst. Director (H)		1		
D.A.D. (P.H.)		1		
D.A.D. (H)		1		
Chief Public Health Insp.		1		
Inspector of Administration		1		
Senior Establishment Officer		1		
Establishment Officer (Ex Labour Officer)		1		
Principal Matron		1		
Controller of Midwives		1		
Principal, School of Hygiene		1		
Head Staff Clerk		1		
Staff Clerk		4		
Secretary to M. of H.		1		
Senior Clerk... ..		9		
Clerk		20		
Junior Clerk (including M. of H. Office)		8		
FINANCE BRANCH.				
Controller of Accounts		1		
Inspector of Accounts		1		
Head Accountant		1		
Accountant		4		
Senior Bookkeeper		4		
Book-keeper		19		
Junior Book-keeper		2		
STORES SECTION.				
Cont. Medical Stores		1		
Asst. Cont. Medical Stores		1		
Supt. of Stores		2		
Stock-Verifier		1		
Senior Storekeeper		3		
Storekeeper		16		
Storekeeper U.T.		10		
Junior Storekeeper		8		
TOTAL		130		

includes one L.C.
Post.

CATEGORY	Establishment			
	British	Sudanese	Egypt	Syrians & Others
HOSPITALS AND DISPENSARIES.				
Senior Physician and Dir. K. C. H. ...		1		
Senior Surgeon		1		
Senior Obstet. and Gyn.		1		
Senior Ophthalmologist		1		
Physicians	3	6		
Chest Physicians		1		
Psychiatrist		1		
Surgeons	3	6		
Ophthalmologist		6		
Gynaecologist	1	5		
Radiologist		1		
S.M.Os./ M. Inspectors	—	26	3	
Medical Officer	2	40	32	10 } G. D.
Medical Officer (Study Courses)	6			2 } Doctors
House Officers (Housemen)	—	26		
Dental Surgeon	1	1		
Dental Officer			1	
Dental Mechanic	1			
Dental Mechanic (Trainee)		3		
Pharmacist		1		2
Lay Administrator		1		
Lay Administration (Trainee)		1		
Senior Dispenser		5		
Dispenser and Dispenser U.T.		121		
Controller of Radiography... ..	1			
Senior Radiographers		2		
Radiographer and Radiographer U.T.		18		
Hospital Manager		3		
Hospital Matron	6			
Asst. Matron	9	3		
Supt. Nursing Officer	6	2		
Physiotherapist	4			
Senior Nursing Sisters	11	26		5
Asst. Supt. N. Officer		2		
Nursing Sister		27		
Nurse U.T.		2		
Senior Nursing Instructor		2		
Nursing Instructor		24		
Ophthalmic Assistant		2		
Refractionist		2		
Theatre Attendant		48		
Head Mumarid		43		
Laboratory Technicians		5		
Senior Med. Assistant		15		
Medical Assistant		465		
Senior Clerk... ..		7		
Clerk		23		
Junior Clerk		12		
Senior Book-keeper		13		
Book-keeper		20		
Junior B/Keeper		33		
Senior Storekeeper		1		
Storekeeper		15		
Junior S/Keeper		5		
Junior S/Keeper (Ex. Ration Clerk)		31		
Storekeeper U.T. (Southern Hospitals)		10		
Telephone Operator		7		
Quarantine Overseer		2		
Southern Trainee		10		
TOTAL	54	1035	36	19

CATEGORY	Establishment			
	British	Sudanese	Egypt.	Syrians & Others
PUBLIC HEALTH.				
Prov. M.O. Health...		11		
Asst. Prov. M.H.O.		8		
Woman Doctor	1			
Port Health Officer	1			
Principal, M.T. School	1			
Asst. Principal M.T. School		1		
Supt. Midwives Training		5		
Principal, H.V.T. School	1			
Asst. Principal, H.V.T. School		1		
Senior Health Visitors		6		
Senior Staff Midwife		6		
Health Visitors		9		
Staff Midwife		15		
Senior P.H. Inspector		10		
Public Health Inspector		11		
Public Health Officer		36		
Senior Sanitary Overseer		1		
Sanitary Overseer		146		
Sanitary Overseer U.T.		12		
S.Os. (P.H. Student U.T.)		31		
Senior Technical Clerk		1		
Clerk		5		
Junior Clerk		12		
TOTAL	4	327	—	—
RESEARCH AND LABORATORIES.				
<i>(a) Stack Medical Research.</i>				
Asst. Director, Research		1		
Bacteriologist		1		
Pathologist	1			
Registrar		1		
Supt. Laboratory	1			
Lab. Technician	3	8		
	5	11		
Lab. Asst. (including Refresher Course)		73		
Head Lab. Attendant		2		
Junior Tech. Asst.		1		
Senior Clerk		1		
Clerk		1		
Junior Clerk		1		
TOTAL	5	90		
<i>(b) Chemical Labs. (W.R.L.).</i>				
Govt. Analyst	1			
Asst. Govt. Analyst	1	2		
Asst. Scientific Officer (U.T.)		2		
Senior Tech. Assistant		2		
Technical Assistant		5		
Junior Tech. Asst.		3		
Clerk		1		
TOTAL	2	15		

CATEGORY	Establishment			
	British	Sudanese	Egypt.	Syrians & Others
(c) <i>Medical Entomology.</i>				
Medical Entomologist	1			
Entomological Technicienian.		1		
Tech. Assistant		1		
Junior Techn. Asst.		2		
Junior Clerk		1		
TOTAL	1	5		
(d) <i>Schistosomiasis.</i>				
Biologist	—	1		
Senior Tech. Asst.		1		
Tech. Assistant		1		
Clerk		1		
Storekeeper		1		
TOTAL	—	5		
(e) <i>Graphic Museum.</i>				
Tech. Assistant		1		
Museum Attendant		2		
TOTAL	—	3		

SUMMARY-CLASSIFIED STAFF.

CATEGORY	Establishment			
	British	Sudanese	Egypt.	Syrians & Others
Headquarters	—	130	—	—
Hospitals	54	1035	36	19
Public Health	4	327	—	—
Stack Medical Research	5	90	—	—
Chemical Analytical Sec.	2	15	—	—
Medical Entomology	1	5	—	—
Chistosomiasis	—	5	—	—
Graphic Museum	—	3	—	—
GRAND TOTALS	66	1610	36	19

Unclassified staff numbered 7400 approximately.

PHYSICIANS ETC. PRACTISING IN THE SUDAN.

APPOINTMENT	Govt. Officials Serving with Ministry of Health	Private Practice No.
Specialists	16	—
Physicians	12	8
Surgeons	11	—
General Duty Doctors	102	—
Dentists	3	20
Pharmacists	3	33
Dispensers	21	—
Medical Assistants	481	—

(b) **LEGISLATION.**

The following legislations affecting public health were enacted during the year :—

Ordinances.

Date			Title	Provision
15.12.54	...	...	The Quarantine Ord. 1954	In order to prevent the Introduction into and spread in or from the Sudan of Quarantinable diseases.
15.5.1955	...	...	The Medical Council Ordinance	To establish a council to control the practice of medicine, dental surgery and pharmacy in the Sudan.
RULES AND ORDERS				
15.6.1955	...	...	The Quarantine order Amendment No. 1 Ord.	An order to amend the Quarantine Ordinance 1954

(c) **FINANCE.**

TABLE II. (A).

*Income and Expenditure of Ministry of Health
over the last 4 years.*

ITEM	1951/52 £E.	1952/53 £E.	1953/54 £E.	1954/55 £E.
Revenue :	46,779	50,260	48,063	42,819
Expenditure :				
Personnel and Personal Allowances ...	1,222,093	1,317,580	1,416,249	1,428,600
Services	777,647	978,397	1,174,255	1,360,923
Extraordinary	32,489	26,182	36,083	16,767
TOTAL	2,032,229	2,322,141	2,626,587	2,806,290

TABLE II. " B "

*Anyalysis of the Expenditure of the Ministry of Health
In 1954/55 from 1.7.1954 to 30.6.1955.*

SECTION	Personnel	Services	Extra-ordinary	Total
	£E.	£E.	£E.	£E.
(a) Headquarters	96,096	288,199	—	384,295
(b) Hospitals	1,086,862	862,544	16,767	1,966,173
(c) Hygiene and Public Health	191,167	204,415	—	395,582
(d) Research	54,073	5,765	—	59,838
(e) Graphic Museum	402	—	—	402
(f) Seconded Staff	—	—	—	—
TOTAL	1,428,600	1,360,923	16,767	2,806,290

CHAPTER III.
PUBLIC HEALTH.
(a) HEALTH OF OFFICIALS.

TABLE III.

NATIONALITY		Number of officials employed	Number Placed on sick list	No. of days sick	Average days sickness		Died	Invalided
					For all officials	For those reported sick		
British	1953/54	1,111	185	1,101	0.99	5.95	1	3
	1954/55	732	102	1,012	1.04	9.92	—	3
Sudanese	1953/54	8,774	2,219	20,347	2.32	9.17	5	8
	1954/55	9,007	2,585	22,805	2.53	8.82	3	1
Others	1953/54	164	47	393	2.39	8.36	0	3
	1954/55	176	55	432	2.45	7.85	0	—

(b) GENERAL HEALTH.

There was further expansion in facilities for Curative Medicine as will be seen later in the number of new hospitals and Dispensaries established.

A noticeable feature of the year was the increasing attention given to rural sanitation and the fight against major endemic diseases of Bilharzia, Kala-Azar, Sleeping Sickness, Tuberculosis and Malaria. Organised systematic campaigns have already been operating against some and surveys and preparation for control of others are completed.

Table IV. below illustrates the work done in hospitals and dispensaries in the last ten years and clearly shows an ever-rising trend.

TABLE IV.

Work done in hospitals and dispensaries.

YEAR							Admissions	Attendances	Operations
1945	...	...	...	...	...	...	131,571	7,897,148	15,455
1946	...	...	...	...	...	...	126,586	8,474,874	15,509
1947	...	...	...	...	...	...	142,294	9,253,251	16,785
1948	...	...	...	...	...	...	140,511	9,820,304	17,573
1949	...	...	...	...	...	...	151,011	10,186,668	21,327
1950/51 (18 Months)	...	...	...	...	...	...	302,526	16,503,371	31,459
1951/52	...	...	...	...	...	...	168,251	12,181,931	26,021
1952/53	...	...	...	...	...	...	164,331	13,966,390	26,114
1953/54	...	...	...	...	...	...	172,675	14,483,366	34,432
1954/55	...	...	...	...	...	...	171,092	16,453,892	38,285

There were 81 licenced private practitioners working independently during the year under review whose statistics are not included above.

(c) VITAL STATISTICS.

The official census which was started towards the second half of the year is still going on and so no accurate figures could be quoted. So far it appears that the actual population would be higher than what was hitherto estimated.

TABLE V.
Estimated population of Provinces.

PROVINCE	Men	Women	Children	Totals
Bahr El Ghazal	280,268	335,033	449,786	1,065,087
Blue Nile	559,872	671,633	862,746	2,094,251
Darfur	234,183	376,914	504,609	1,115,706
Equatoria	166,961	210,914	292,125	670,000
Kassala	117,441	100,937	110,056	328,434
Port Sudan	132,344	145,835	232,505	510,684
Khartoum	162,354	159,260	248,172	569,786
Kordofan	507,093	651,131	1,102,617	2,260,841
Northern	205,196	273,614	357,279	836,089
Upper Nile	205,050	271,661	416,062	892,773
TOTAL	2,570,762	3,196,932	4,575,957	10,343,651

TABLE VI.
*Estimated population of towns of Khartoum,
Khartoum North, Omdurman.*

TOWN	Men	Women	Children	Total
Khartoum	35,262	28,372	30,549	94,183
Khartoum North	17,126	16,218	24,837	58,181
Omdurman	36,587	48,459	54,186	139,232

TABLE VII.
*Crude birth rate. Khartoum, Khartoum North,
Omdurman.*

TOWN	No. of registered Births	Crude Birth Rate
Khartoum	2,771	29.4
Khartoum North	1,330	22.8
Omdurman	4,077	29.0

These figures are calculated from births attended by Trained Midwives who usually register these cases but by no means must these be taken as accurately representative of the real picture. Registration of births and deaths are nowhere complete.

(d) PREVENTIVE MEDICINE.

1. Insect-borne Diseases.

(a) *Malaria*. The incidence fluctuated as usual. While a decrease was recorded in Northern Province, a sharp epidemic occurred in Gezira, Managil area and part of the White Nile Area, as a result of heavy rains and high floods. In the northern province a combined campaign against adult and aquatic stages of mosquitoes was conducted to guard against epidemic as a result of high Nile.

The Egyptian Government contributed in adult control by sending two teams which operated from Ghaba station to Halfa. This was done to help the Sudan and also to guard against invasion by the Gambia mosquito of Upper Egypt and the repetition of the 1942 outbreak.

The residual spraying method is expanding to cover larger villages in rural areas but there are no reliable data to assess the success of such expansion. There are factors which should be considered before claiming any good results. Amongst these are the lack of proper supervision because of the scarcity of qualified staff and inefficiency of the transport because of bad roads which influence the timing of the spraying.

In the Gezira Irrigated Area where Residual spraying and larvacidal control continued well supervised and timed, the incidence showed an abrupt increase. The causes, as arrived at, after the investigation carried by Province Medical Officer of Health, Gezira Irrigated Area were :—

(1) The Managil outbreak which was due to heavier rain fall that neutralised the protecting effect of the volatile gammexane by washing it away and the lapse of time between the last spraying and the start of the outbreak. The conditions of the roads did not allow the postponement of the second spraying. Because of these two factors it was considered worth while to try D.D.T., being less volatile, and postpone the second spraying as far as the condition of the roads will allow.

(2) Artificial rains which were tried without warning the Health Authorities to take precautionary measures also contributed to the increase. The figures are shown below.

YEAR	No. of cases diagnosed as malaria	Recorded rainfall
1950/51	20,684	327.3 mm.
1951/52	4,336	255.6 mm.
1952/53	4,351	414.4 mm.
1954/55	4,781	393 mm.

The number of rooms sprayed in Gezira Irrigated Area was 242,233.

The number of rooms sprayed in Managil area as an additional measure to combat the outbreak was 23,920.

Managil outbreak started in September and was brought to an end in October by a special campaign.

The Survey conducted in Northern Fung by the Medical Inspector and mentioned in my last annual report was continued during this year and Medical Inspector Fung reports :—

- (a) in villages which have been recommended for removal and resiting the splenic index showed a marked decrease.
- (b) The picture on the whole shows that Malaria is still highly endemic.

He also found it necessary to alter the timing of spraying to coincide with the breeding season, if roads allow, and continue the policy of resiting villages away from swamps created by the back flow of water from the dam.

The White Nile out-break was combatted by a special campaign and was successfully and quickly overcome.

16,303 cases were treated in Hospitals with 337 deaths. Number treated as Outside patient was 439,286.

TABLE VIII.
Species of parasite in 9,749 positive slides :—

PROVINCE						<i>P. Falciparum</i>	<i>P. Vivax</i>	<i>P. Malaria</i>
Bahr El Ghazal	...	...	...	...	...	608	—	—
Blue Nile	...	...	...	...	...	948	103	—
Darfur	...	...	...	...	...	687	76	—
Equatoria	...	...	...	...	...	3,657	69	53
Kassala	...	...	...	...	...	922	76	—
Khartoum	...	...	...	...	...	258	78	2
Kordofan	...	...	...	...	...	1,510	218	—
Northern	...	...	...	...	...	221	41	—
Upper Nile	...	...	...	...	...	202	5	15

(ii) *Blackwater fever.* The continuous decline in the incidence of this disease persists. Whether that is due to the change of method of treatment from quinine to other synthetic drugs or some other factors it cannot be said. Number of cases recorded was 8.

(iii) *Relapsing Fever.* No outbreak of this disease was encountered ; only three imported cases were spotted in Khartoum and treated. Delousing by D.D.T. which is applied at all posts of entry to Sudan on imported labour has removed the worry that this disease used to create in the past. List of cases and Deaths during the last ten years is as follows :

TABLE IX.
Relapsing Fever : Cases and Deaths over 10 years.

YEAR							Cases	Deaths
1945	...	...	...	...	...	...	17,392	444
1946	...	...	...	...	...	...	1,952	65
1947	...	...	...	...	...	...	568	67
1948	...	...	...	...	...	...	287	8
1949	...	...	...	...	...	...	376	3
1950/51	...	...	...	...	...	...	36	2
1951/52	...	...	...	...	...	...	12	0
1952/53	...	...	...	...	...	...	97	14
1953/54	...	...	...	...	...	...	91	8
1954/55	...	...	...	...	...	...	3	1

(iv) *Leishmaniasis*. More light has been focussed on this disease which showed an upward incidence.

In Gedaref area, the localisation of case incidence continued which brought more villages in the picture and the whole endemic zone became more or less defined. This will facilitate future active steps.

In the Fung the Survey was augmented by laboratory diagnosis and more areas and villages were examined. The phase of case treatment is already in hand and this will be followed by protective measures as part of the proposed anti-malaria campaign in that area.

At Melut in Upper Nile a special treatment team was detailed to deal with the diseases.

P. lesleyar against which more evidence is accumulating as being the responsible vector in the Fung area was again detected in greater numbers in Fung area.

TABLE X.
Leishmaniasis : recorded incidence in 10 years.

YEAR								No. of Cases
1944	...	...	...	...	...	...	...	205
1945	...	...	...	...	...	...	...	192
1946	...	...	...	...	...	...	...	246
1947	...	...	...	...	...	...	...	327
1948	...	...	...	...	...	...	...	460
1949	...	...	...	...	...	...	...	523
1950/51	...	...	...	...	...	...	...	638
1951/52	...	...	...	...	...	...	...	1,063
1952/53	...	...	...	...	...	...	...	613
1953/54	...	...	...	...	...	...	...	895
1954/55	...	...	...	...	...	...	...	1,106

(18 months period)

TABLE XI.
Leishmaniasis, 1954/55 : Distribution by provinces.

PROVINCE								Cases	Deaths
Blue Nile	...	...	...	...	...	...	...	546	29
Darfur	...	...	...	...	...	...	...	20	1
Equatoria	...	...	...	...	...	...	...	46	2
Kassala	...	...	...	...	...	...	...	282	20
Khartoum	...	...	...	...	...	...	...	15	3
Kordofan	...	...	...	...	...	...	...	4	1
Northern	...	...	...	...	...	...	...	3	—
Upper Nile	...	...	...	...	...	...	...	190	3
TOTAL	...	...	...	...	...	...	...	1,106	59

(v) *Trypanosomiasis*. The increased incidence reported last year reached epidemic proportions in Yambio and Yei areas. The pentamidine prophylaxis scheme mentioned in my last report started to operate in May—the number to be protected was estimated at 100,000 and the project after preliminary preparation with W.H.O. expert proceeded smoothly. Valuable suggestions were rendered by Dr. Haddad the W.H.O. expert which received careful study by the Ministry for future guidance. The total number discovered in the course of the year was 559 in both Yambio and Yei. In other Endemic Zones two cases from Meridi were reported of which one was traced to Yei. No case was discovered in Li Yubu area.

The number of exposed persons who were given protective injections until the closure of the year was 50,000.

It follows that the operation of full scale fly control has been abandoned.

TABLE XII.

Trypanosomiasis : Distribution of Cases in Equatoria in 10 years.

YEAR	Yubu	Yambio	Yei	Kajo-Kaji	Meridi	Imported	Other Localities
1945 ...	16	1	19	—	—	—	3
1946 ...	21	19	16	—	—	—	—
1947 ...	18	6	21	—	2	—	—
1948 ...	32	23	20	—	—	—	—
1949 ...	5	12	17	—	—	—	—
1950/51	15	33	12	—	—	—	—
1951/52	—	93	3	—	26	—	—
1952/53	—	53	13	—	—	2	—
1953/54	12	148	44	—	—	—	—
1954/55	—	467	92	—	1	1	—

(vi) *Filariasis*. 1,015 Cases were microscopically diagnosed during the year. 984 cases of this total came from Bahr El Ghazal and Equatoria provinces of the South. 15 cases of Onchocerciasis were diagnosed at Lui.

2. EPIDEMIC AND ENDEMIC DISEASES.

(i) *Anthrax*. 53 cases with 3 deaths were reported.

(ii) *Cerebrospinal meningitis*. This disease showed its presence in all the provinces of the Sudan during the year, varying from sporadic incidence in some provinces to epidemic stages in others, like Bahr-El-Ghazal and Upper Nile. In the former, the last year epidemic smouldered on and flared up again during the months of January, February and March. Total cases seen were 2,142 with 249 deaths a mortality rate of 11%.

The same method of treatment of last year i.e. suspension of sulphathiazole the injections and by mouth for children was followed.

In Upper Nile, the outbreak started in Renk, Malakal, Kodok areas in January, 1955 with a total of 577 cases and 60 deaths giving 10% mortality rate.

The noticeable feature was the prompt notification of the occurrence of the disease and the earlier reporting of cases. This is clearly reflected on the fatality rate especially in Upper Nile.

TABLE XIII.

Cerebrospinal meningitis : Recorded incidence and fatality 1954/55.

PROVINCE						Cases	Deaths	Fatality Rate
Blue Nile	...	...	...	...	...	103	22	21.4
Darfur	...	...	...	...	...	318	76	23.9
Kassala	...	...	...	...	...	53	17	32.1
Khartoum	...	...	...	...	...	56	7	12.5
Kordofan	...	...	...	...	...	153	44	28.7
Northern	...	...	...	...	...	23	9	39.1
Total Northern Provinces						706	175	24.7
Bahr El Ghazal	...	...	...	...	...	2,142	249	11.6
Equatoria	...	...	...	...	...	23	8	34.7
Upper Nile	...	...	...	...	...	599	60	10.0
Total Southern Provinces						2,764	317	11.4
Over all Total						3,470	492	14.2

TABLE XIV.

Cerebrospinal meningitis : Recorded incidence and fatality over 10 years.

YEAR								Recorded cases	Recorded deaths	Fatality rate.
1945	...	...	...	...	...	...	...	6,166	666	10.8
1946	...	...	...	...	...	...	...	730	155	21.2
1947	...	...	...	...	...	...	...	443	159	35.9
1948	...	...	...	...	...	...	...	170	59	34.7
1949	...	...	...	...	...	...	...	353	102	28.9
1950/51 (18 months)	...	...	...	...	...	...	...	57,575	7,710	13.4
1951/52	...	...	...	...	...	...	...	14,527	2,031	14.0
1952/53	...	...	...	...	...	...	...	2,938	644	21.9
1953/54	...	...	...	...	...	...	...	8,942	827	9.2
1954/55	...	...	...	...	...	...	...	3,470	492	14.2

(iii) *Diphtheria*. The cases were diagnosed by Culture methods where possible and so some clinical cases were included as well.

More incidence was recorded in Blue Nile and Khartoum Provinces.

TABLE XV.

Diphtheria : Recorded incidence and fatality, 1954/55.

PROVINCE							Recorded cases	Recorded deaths	Fatality rate
Bahr El Ghazal	...	...	...	...	...	...	1	1	100.0
Blue Nile	...	...	...	...	...	...	102	22	21.5
Darfur	...	...	...	...	...	...	8	1	12.5
Equatoria	...	...	...	...	...	...	11	2	18.1
Kassala	...	...	...	...	...	...	39	13	33.3
Khartoum	...	...	...	...	...	...	124	9	7.3
Kordofan	...	...	...	...	...	...	29	5	17.3
Northern	...	...	...	...	...	...	49	8	16.5
Upper Nile	...	...	...	...	...	...	6	0	—
							369	61	16.5

TABLE XVI.

Diphtheria : Recorded incidence and deaths in 10 years.

YEAR								Cases	Deaths
1945	...	...	...	...	...	...	...	389	54
1946	...	...	...	...	...	...	...	390	61
1947	...	...	...	...	...	...	...	319	37
1948	...	...	...	...	...	...	...	326	27
1949	...	...	...	...	...	...	...	264	36
1950/51 (18 months)	...	...	...	...	...	...	...	573	77
1951/52	...	...	...	...	...	...	...	280	30
1952/53	...	...	...	...	...	...	...	717	37
1953/54	...	...	...	...	...	...	...	335	27
1954/55	...	...	...	...	...	...	...	369	61

(iv) *Dysentery*. 4,009 cases were treated in Hospitals and 75,820 as Out patient cases. No attempt is made to classify the varieties and types as the conditions under which many cases were treated do not permit quick contact with Central Laboratories, but both Bacillary and Amoebic types do occur.

(v) *Enteric Fever*. Admissions to Hospitals showed more decrease this year but the main foci of infection remained the same with the Northern Province heading the list then Blue Nile, Kassala and Khartoum, but no single province escaped the disease.

Tests of the water of wells suspected last year as the source of infection in Blue Nile were negative.

TABLE XVII.

Enteric fever : Distribution 1954—55.

PROVINCE								Cases	Deaths
Bahr El Ghazal	...	...	...	...	...	...	...	86	1
Blue Nile	...	...	...	...	...	...	...	137	2
Darfur	...	...	...	...	...	...	...	5	—
Equatoria	...	...	...	...	...	...	...	1	—
Kassala	...	...	...	...	...	...	...	76	15
Khartoum	...	...	...	...	...	...	...	57	7
Kordofan	...	...	...	...	...	...	...	13	2
Northern	...	...	...	...	...	...	...	170	7
Upper Nile	...	...	...	...	...	...	...	3	—
TOTAL								548	34

TABLE XVIII.

Enteric fever : Incidence over 10 years.

YEAR								Recorded Cases	
1945	...	...	...	...	...	...	...	183	
1946	...	...	...	...	...	...	...	116	
1947	...	...	...	...	...	...	...	144	
1948	...	...	...	...	...	...	...	202	
1949	...	...	...	...	...	...	...	311	
1950/51 (18 months)	...	...	...	...	...	...	...	560	
1951/52	...	...	...	...	...	...	...	578	
1952/53	...	...	...	...	...	...	...	598	
1953/54	...	...	...	...	...	...	...	560	
1954/55	...	...	...	...	...	...	...	548	

(vi) *Gastro-enteritis of Children*. Records of Hospitals and Dispensaries registered 62457 cases of which 1632 required hospitalization, with 174 deaths a fatality rate of just over 10 per cent.

(vii) *Leprosy*. The change of method towards domiciliary treatment of lepers with sulphone is making headway in many parts and is reported on as giving encouraging results. However, the old settlements in the country of which there are 14 still continue to function and care for the old inmates and mutilated disabled. Admission was discouraged and only limited to the completely disfigured patients whose treatment as Out-patients created social objection.

The total number of inmates in settlements in the country was 2,098.

Province Medical Office, Blue Nile Province reports that 77 per cent of cases in Ingasana Hills were of the neural type.

During the year 1,106 were diagnosed of which 715 came from Equatoria, the known heavily endemic zone.

The policy of making supplies of Sulphone available in all dispensaries was advised and special treatment cards were to be kept for out-patient cases.

(viii) *Poliomyelitis*. 99 cases were recorded this year—this is a higher figure compared to previous records—of these 61 were diagnosed in Khartoum, 26 in Kordofan. Only 14 of the recorded cases received hospital treatment.

(ix) *Rabies*. 12 human cases were recorded during this year. 70 Brain animals were found positive for negri bodies.

Immunisation of Dogs by Rabies vaccine was extended to many towns in the country.

(x) *Small-Pox*. The outbreak of Darfur was successfully overcome and brought to an end during the year—this entailed great vigilance and endurance from the responsible staff who took pains—taking tours and inspections and supervising quarantines and vaccination. The last strong-hold of the disease at Gabal Mara was wiped out.

Cases appeared at Fasher, Northern, Western and Southern districts and Darmasalit but the incidence was most heavy in Western and Southern regions. Immigrants arriving from the West Africa with false vaccination certificates contributed to the appearance of cases in Fasher and other parts and it was at last possible to control this danger.

In Kordofan, which borders three danger zones, Bahr El Ghazal, Darfur and Upper Nile, it was imperative to take vigorous steps to guard against invasion. An immunity belt was created by the vaccination of all people living near the borders of the three provinces and especial quarantine posts were guarding caravan routes. Only 11 imported cases were detected and a total of 428,923 vaccinations performed. The success of this well planned scheme is reflected in the very few cases recorded. In Equatoria the infection spread inevitably from Bahr El Ghazal to Li-Yubu area where an outbreak occurred in Sept. producing 135 cases with 7 deaths. Vaccinations numbering 44,000 were done and the outbreak died out in December. In other parts of Equatoria cases were encountered and the infection spread as a result of the uncontrolled movements from Bahr El Ghazal. However, the incidence was confined to its localities and protective vaccinations were done. Li-Rangi, Meridi, Torit and Lui were the scenes of these localised incidence. Total cases in all were 84. In Bahr El Ghazal which was the scene of last year's outbreak, the disease continued with lesser intensity and measures against it also continued.

The C.S.M. outbreak in this province had in the words of the Province Medical Officer of Health “ helped to eradicate Small-Pox. The fear from C.S.M. compelled patients and contacts to report where they were vaccinated.”

Total cases were 2,142 with 249 deaths, a mortality rate of 13.9 per cent.

All the reports speak of the factors that work against the conduct of operations, lack of quick transport, loss of potency of lymph through improper storage, the desire of people to evade vaccination and inaccessibility of certain parts during the rains. Inspite of all these difficulties the efforts yielded good result of control in some places and eradication in other places, and the situation and picture have both changed to the better.

Total cases recorded in the whole country were 4,200 with 584 deaths, a mortality rate of 13.4 per cent and the total vaccinations performed were 1,203,673.

(xi) *Tuberculosis*. The International team and the matching national team have concluded their pilot scheme of Manteau testing in all provinces and the vaccination of negative reactors. The valuation of the surveys and comments will be the subject of a separate report but it can be said now that nearly 50 per cent of the Sudan population under the age of 25 will require B.C.G. vaccination and the rate of infection appears to be equal all over the Sudan with only little variation in some provinces.

The propoganda initiated by the Egyptian scientist against the use of B.C.G. was successfully defeated by counter views and the scheme proceeded smoothly according to plan. In all the country 65,162 tests were carried out, of these 26,602 were non-reactors and were vaccinated with B.C.G.

The Chest Disease Unit in Khartoum and Omdurman retained the same number of staff which was two Chest Physicians and 7 Tuberculosis visitors with the necessary anciliary nursing and Laboratory staff. The number of beds remained as 175 but an appreciable expansion in domiciliary treatment was made. A rehabilitation centre for convalescents was opened during the year. It was the outcome of the joint efforts and thinking of the Red Cross, Red Crescent and the National Committee for the Prevention of Tuberculosis. It is financed through donations and subscriptions. The Centre proved popular and the convalecents making full use in learning suitable trades to earn their living. The products of these trades in way of shoes, needle work and chairs have already found their way to the market. Its importance as diversional therapy as well need not be emphasised. Follow up of contacts was also maintained.

The total number of cases seen and diagnosis during the year was 2,473 as compared to 1,454 in the previous year.

TABLE XIX.
Tuberculosis : Admissions to Hospital in 10 years.

YEAR					Pulmonary	Non-Pulmonary	TOTAL
1945	...	...	...	...	957	643	1,600
1946	...	...	...	...	888	613	1,501
1947	...	...	...	...	877	599	1,476
1948	...	...	...	...	1,019	604	1,623
1949	...	...	...	...	1,176	650	1,826
1950/51	(18 month)	...	...	...	1,611	883	2,494
1951/52	...	...	...	...	1,325	747	2,072
1952/53	...	...	...	...	1,679	671	2,350
1953/54	...	...	...	...	2,075	798	2,873
1954/55	...	...	...	...	2,868	915	3,783

TABLE XX.

Tuberculosis 1954/55 Hospital Admissions by Provisions.

PROVINCE	Pulmonary	Non-Pulmonary	TOTAL
Bahr El Ghazal	193	21	214
Blue Nile	425	118	543
Darfur	93	38	131
Equatoria	140	38	178
Kassala	554	188	742
Khartoum	826	137	963
Kordofan	281	134	415
Northern	250	177	427
Upper Nile	106	64	170
TOTAL	2,868	915	3,783

TABLE XXI.

Tuberculosis, 1954/55 Distribution of all cases Diagnosed.

PROVINCE	Pulmonary	Non-Pulmonary	TOTAL
Blue Nile	555	278	833
Darfur	132	108	240
Kassala	684	374	1,058
Khartoum	740	380	1,120
Kordofan	347	193	540
Northern	428	337	765
Total Northern Provinces ...	2,886	1,670	4,556

The most important event in this field was the establishment of the rehabilitation centre for the training of ex-tuberculosis patients, in the various trades compatible with their disabilities with a view to make them eventually self-supporting and useful members of the community.

The centre was formed by the joint participation of the local branch of the Red Cross, the local branch of the Red Crescent and the Sudan Association for the prevention of tuberculosis.

The work in the rehabilitation centre was started on the 1st. of December, 1954 and the Prime Minister graciously performed the opening ceremony on the 6th. of January, 1955.

Twenty-six men and eleven women are receiving training in the centre and their attendance and enthusiasm has been extremely good. The articles now manufactured by these ex-patients are the various forms of canework e.g. garden chairs and basketry (laundry, picnic, breakfast, and waste-paper baskets) as well as chair re-caning. Another section of men are receiving training in leather works, shoes, sandals, slippers etc.

Women are trained in embroidery and various forms of needlework including ladies dressmaking.

It is most interesting to note that among the thirty-seven ex-patients only one had a relapse which necessitated her removal from the centre.

(xii) *Undulant Fever*. Forty-seven cases were spread over all provinces except Bahr El Ghazal and Upper Nile.

3. HELMINTHIC DISEASES.

(i) *Ankylostomiasis*. 7,596 of 8,028 cases reported were in the two southernmost provinces.

(ii) *Drancontiasis*. 7,202 cases were treated. With the expansion of Haffirs as the main rural water supply the menace of this disease will remain great. Active steps were taken to supervise and control these artificial lakes to prevent pollution as the number of carriers of this disease amongst the labourers is great. The disease was encountered more in Bahr El Ghazal, Equatoria, Kassala and Kordofan provinces. Fencing and guarding the Haffirs is always insisted on.

(iii) *Schistosomiasis*. As a result of the successful trials of Sulphation against snails in canals in the Gezira which received the approval of the Biologist, and the new trial with suspension bags for maintenance dose which will have a concentration of 0.125 per million and proved acceptable by the Irrigation Engineers in that it did not interfere with the water flow and proved effective in preventing re-entry of snails, the ministry has worked out a comprehensive scheme for snail eradication by initial sulphation of all canals followed by continuous maintenance dose. This will cost £E. 200,000. Preparations to start the work next season are all ready now. The report rendered by the W.H.O. expert was in full support of the project. The success of the pilot scheme of sulphation in Gezira had encouraged those responsible to take the same steps in the big Geneid Scheme on the East of the Blue Nile and apply the same method from the start in order to give no chance for snail infestation of the Canals of this large scheme and face another Bilharzia problem in that part. This will cost nearly £E. 5,000 it is estimated.

The disease remains to be a serious menace to every agricultural project and many of these projects are on the way.

Because of this, surveys have been carried out in Northern Fung where the new Damazeen Dam will result in great agricultural developments. Khors were surveyed which were found heavily infested with snails and inhabitants living in villages that obtain their water from these sources showed a high percentage of infection. All these data will facilitate formulating measures for future control and eradication.

Sex							No. Examined	No. Infected.					
								M.	H.				
Males	...	...	...	...	...	...	5,677	384	19
Females	...	...	...	...	...	...	5,865	255	25
Children	...	...	...	...	...	...	7,381	627	32
TOTALS							18,923	1,266	76

E. SANITARY CIRCUMSTANCES.

Water Supplies.

Although new piped pumped water projects were undertaken during the year, the expansion in Haffirs and Dams and the improvement of existing water works continued in various rural and urban areas. As mentioned before all precautions to prevent contact with water and its pollution were again tightened. Samples from various parts were regularly sent for testing and found fit for human use. At Abu Deleig water samples from wells were tested and found to contain a high percentage of flourine, a fact which was found apparent on teeth of children. At Gedaref and Managil scarcity of water caused great anxiety during the dry spell. In Darfur and Kordofan with good rains, the Haffirs proved their worth and there were no complaints from the people of these usually dry parts.

In the Northern Province the extension of piped water to Halfa Degheim was carried out while in Port Sudan supply to the east of the town and erection of stand pipes in Deims was made possible by replacement of narrow mains by larger ones.

In the Gezira Irrigation Area some 454 villages still rely on canals for their water supply and the danger of pollutions is great.

In Blue Nile Province private schemes a new scheme to guard against pollution was devised by pumping water into protected ground Reservoirs from which people draw their water by hand worked pumps.

In Bahr El Ghazal the policy of digging more anti-guinea worm wells and filling in unhygienic ones continues.

In Kassala the project of supplying the Gash Delta Towns and villages with piped water from Kassala Town is in progress. In Equatoria the Meridi Dam was completed.

Refuse Disposal. This is still carried out by tipping and open burning and filling depressing in perimetre of towns. The interest of Councils in village cleaning in Gezira was maintained and has greatly changed the picture.

Sewage Disposal. The method used in most towns of the Sudan is the bucket system. It is expensive and unsatisfactory, as a result of exposure of the contents to flies with the result of spread of fly born diseases, but no satisfactory alternative has as yet been found. Septic tanks are extremely expensive and their use is only limited to special class of people. Hope lies now in the aqua privy type of latrine which has been gradually replacing bucket latrines in Atbara town where there are now 1,501 latrines satisfactorily operating. Trials are being made in various parts of the Sudan to replace buckets latrines by aqua privy type and in some towns, like Kassala, the experiment has proved to be a success now the project of replacement is seriously considered.

The work on the drainage system in Khartoum is progressing satisfactorily.

Pit latrines are in use in most places where soil condition and level of sub-soil water would permit digging to the standard depth required which is 8 metres.

Housing and Town Planning. Building operations of houses in towns continued and an improvement of designs and re-planning progressed satisfactorily in many towns.

Village planning in Gezira was hampered by technical difficulties but the project was not discarded and it is hoped to overcome the difficulties and proceed with the replanning and laying out of villages.

Food in relation to health. Scarcity of grain caused some concern for some time in some parts of the country but nowhere actual state of famine existed. The unbalanced diet of the nomads which is also quantitatively below standards remained the same and evidence of malnutrition amongst them was found.

Anaemia, especially amongst expectant mothers, is common amongst these tribes.

Industrial Hygiene. In most of the big towns, defined industrial areas are being established where all industries are concentrated.

This has greatly facilitated the supervision of state of health of workers and the ages of employed men.

CHAPTER IV.

SOCIAL HYGIENE.

Midwifery. Table XXIV shows the midwifery training schools working at the end of the year, date of foundation of each school, total number of midwives trained in the school since opening and the number trained in 1954/55.

TABLE XXIV.

School	Date of Opening	Total Midwives Trained since Opening	Total trained in 1954/55
Omdurman	1920	736	41
El Obeid	1948	22	4
Juba	1950	12	3
Malakal	1952	6	4
Wad Medani	1953	8	8
Athara	1955	Nil.	10
			(still under training).
		784	70

TABLE XXV.

Distribution of licensed midwives trained in the Sudan 30.6.54.

PROVINCE	District Midwives	Certificated Nurse	Uncertificated nurse midwives	Health Visitors	TOTAL
Bahr El Ghazal	—	3	2	—	5
Blue Nile	118	5	3	5	131
Darfur	31	2	—	1	34
Equatoria	1	—	10	1	12
Kassala North	14	9	—	2	25
Kassala South	17	1	1	—	19
Khartoum	109	28	2	9	148
Kordofan	55	4	4	3	66
Northern... ..	105	5	3	2	115
Upper Nile	11	—	2	—	13
	461	57	27	23	568

Maternal and Child Health. With the new constitutional development that has taken place in the Sudan the services of all the women doctors previously engaged in this field were ended. All the expatriate Senior Nursing Officers except two have resigned. Their places were now being filled by trained Sudanese women. The work in the clinics is being run by Sudanese doctors and supervision of District Midwives is carried by Province Medical Officer of Health where no Senior Nursing officer is available.

Ante-natal clinics are also run in various small rural dispensaries by District Midwives as shown in distribution list of units below :—

Sudanese health visitors were working in the following stations :—

Khartoum	...	...	...	...	...	4
Omdurman	...	...	...	...	...	4
Khartoum North	...	...	...	...	...	1
Wad Medani	...	...	...	...	...	4
Kosti	...	...	...	...	...	1
El Fasher	...	...	...	...	...	1
Juba	...	...	...	...	...	1
Port Sudan	...	...	...	...	...	2
El Obeid	...	...	...	...	...	3
Atbara	...	...	...	...	...	2
Dueim	...	...	...	...	...	1
Singa	...	...	...	...	...	1

25

The actual number of ante-natal centres and child health centres which were operating during the year was as follows :—

Location	Ante-Natal Centre	Child health centre
Wau	1	—
Kwajok (Mission)	1	—
Wad Medani	3	3
Hassa Heissa	1	1
Kosti	1	1
El Dueim	2	—
Sennar	1	—
Singa	1	—
Roseires	1	1
El Fasher	2	2
Nyala	1	1
Geneina	—	1
Juba	2	2
Lui (Mission)	—	1
Amadi	—	1
Mundri (Mission)	—	1
Torit	—	1
Kassala	4	4
Gedaref	1	1
Port Sudan	4	4
Khartoum	2	2
Khartoum North	2	2
Omdurman	4	4
Khartoum (Rural)	4	4
El Obeid	1	1
Nahud	1	—
Kadugli	1	1
Talodi	1	1
Um-Ruaba	1	—
Abu Zabad	1	—
Moglad	1	—
Abri (Mission)	1	1
Heiban (Mission)	1	1
Atbara	2	2
Merowe	1	—
Wadi Halfa	1	—
Dobeira	1	—
Malakal	1	1
Fangak	1	—
Tonga	1	—

School Medical Service. The number of pupils medically examined was :—

Bahr El Ghazal	...	...	...	...	...	460
Blue Nile	...	...	...	...	...	29,751
Darfur	...	...	...	...	...	4,482
Equatoria	...	...	...	...	...	1,732
Kassala	...	...	...	...	...	15,222
Khartoum	...	...	...	...	...	13,951
Kordofan	...	...	...	...	...	13,419
Northern	...	...	...	...	...	19,224
Upper Nile	...	...	...	...	...	3,185
TOTAL						101,430

Mental Health. The Mental Diseases Board examined 40 cases, classified as follows :—

Schizophrenia	...	...	...	...	...	18
Depression associated with Suicidal tendencies	...	...	...	...	...	1
Recovered	...	...	...	...	...	4
Re-examination	...	...	...	...	...	5
Hypomania	...	...	...	...	...	1
Mental Disorder	...	...	...	...	...	4
Feeble minded	...	...	...	...	...	1
Improved	...	...	...	...	...	1
Aenrosis	...	...	...	...	...	1
Paranoided delusion	...	...	...	...	...	1
Residual mental symptoms	...	...	...	...	...	1
Personality Disorder of Psychopathic Type	...	...	...	...	...	1
Epilepsy	...	...	...	...	...	1

The clinic for nervous disorders at Khartoum North provides Psychiatric Assistance of an extra-mural type as so far no accommodation is available for intramural care.

The Government Psychiatrist reports as follows :—

Figures and Categories. Total number of cases seen during the year amounted to 4,104. Of this total number 479 were new cases and the balance of 3,625 were return attendance. In terms of Males/Females, the figures for the former were roughly 3 times the latter; actual figures being Males 3,096, Female 1,008. The diagnostic range includes practically all varieties of constitutional and Organic Reaction-Types, many of them in comparatively earlier stages of evolution which is a distinct sign of increasing public awareness and appreciation of health problems.

Cooperation with religious healers and persons of key-positions in society is increasingly bringing in more and more patients in earlier phases of illness at a stage when the disturbance is likely to be reversed by treatment.

The work in the Clinic is still run on an Outpatient, extramural basis; and though the lack of intramural facilities and care for which I can still see as yet no possibilities in the near future has given rise to a great deal of unwarranted criticism, unofficial as well as official, the Ministry can positively contribute by the provision in the next two fiscal years of Scholarships abroad for one candidate each year for post-graduate training, as well as by the provision of adequate grants for the con-

tinuation of the project of the practical training of Mental Nurses at Asfourieh Hospital, Lebanon so far sponsored financially by the W.H.O. on behalf of the Sudan Government.

The Criminal Lunatic Asylum is still being run and supervised by the Penal authorities while the share of the Ministry of Health is restricted to the provision of medical care within the framework of the Penal system. The administration is based on techniques strictly penal particularly in relation to pivotal matters of extremely important psychotherapeutic issues such as custody, discipline etc. and from the psychological as well as the sociological view-point they are obsolete, outmoded and hardly in keeping with the progress achieved in our knowledge of human relationships.

The number of inmates in custody at present is 100 males and 10 females making a total of 110. During the year 18 males were admitted and the discharges to various Provinces for local custody amounted to 19 all of them males. 5 inmates died during the year from intercurrent illnesses including one case of death from head injuries inflicted on the deceased by a fellow inmate.

Health Education. The available constant means so far is the use of Radio Omdurman where a weekly talk in medical subjects is given by the Radio Doctor.

The event of tribal gathering is always taken as a chance of exhibiting various posters on local diseases and their prevention, care of the infant and mother and other subjects such as nutrition etc. The interest shown by the people as expressed by questions asked was most encouraging. The trained village midwife also plays a good part in propagating simple elementary hygiene and advice on diets both for the expectant mother and child.

CHAPTER V.

PORT HEALTH: QUARANTINE.

No seaport or airport was declared infected.

Disinsection of aircraft and quarantine control of air travellers was undertaken at Wadi Halfa, Port Sudan, Khartoum, Juba, Malakal, Geneina and El Fasher airports.

The *Aedic* index was calculated on an inspection of all habitations within the area concerned. Table XXVI shows the *Aedic* index throughout the year at certain airports on international routes.

TABLE XXVI.
Aedes Aegypti Index—1954, 55.

MONTH	Fasher	Juba	Kassala	Port Sudan	Khtm.	El Obied	Wadi Halfa	Malakal
July ...	—	0.01	0. 1	—	—	0.15	—	—
August ...	0.08	—	0. 2	—	—	—	—	0. 2
September ...	0.008	—	0. 1	—	—	—	—	—
October ...	—	—	0.07	—	—	—	—	0.05
November ...	—	—	—	—	—	—	—	—
December ...	—	—	—	—	—	—	—	—
January ...	—	—	—	—	—	—	—	—
February ...	—	—	—	—	—	—	—	—
March ...	—	—	—	—	—	—	—	—
April ...	—	—	—	—	—	—	—	—
May ...	—	—	—	—	—	—	—	—
June ...	—	—	—	—	—	—	—	—

Port Sudan Quarantine. 1,404 ships entered Port Sudan harbour. The number of sambuks entering Flamingo Bay was 319. Radio pratique was granted to 684 ships. No case was isolated in the quarantine station.

Suakin Quarantine. The number of pilgrims who have left Suakin for Jeddah in the past 10 years has been :

1945/46	...	...	...	...	...	...	6,214
1946/47	...	...	...	...	...	...	8,404
1947/48	...	...	...	...	...	...	12,020
1948/49	...	...	...	...	...	...	11,105
1949/50	...	...	...	...	...	...	5,091
1950/51	...	...	...	...	...	...	4,666
1951/52	...	...	...	...	...	...	6,491
1952/53	...	...	...	...	...	...	15,051
1953/54	...	...	...	...	...	...	13,950
1954/55	...	...	...	...	...	...	13,921

1,906 pilgrims left Port Sudan for the Hedjaz by air in 1954/55.

All outgoing pilgrims were immunised against cholera, small-pox and yellow fever.

The pilgrimage was declared clean. Returning pilgrims were detained in quarantine only for medical formalities to be undertaken.

Wadi Halfa Quarantine. Routine examination for schistosomiasis of persons entering the Sudan from the north was stopped. Delousing with D.D.T. powder was imposed on third class passengers on reports of typhus fever in Egypt. 649 river vessels were inspected.

Geneina Quarantine. 14,416 persons passed through the post. Delousing with D.D.T. powder was imposed. 1,577 persons were vaccinated against small-pox and 6,823 inoculated against cholera.

Medical Mission to the Hedjaz. The mission consisted of two doctors and 13 other staff. Treatment centres were established at Jeddah, Mecca, Muna and Medina. Medical care was afforded to many nationalities, including pilgrims and local population. 9,059 out-patient cases were treated. 58 persons were given in-patient treatment.

CHAPTER VI.
HOSPITALS—DISPENSARIES—DENTAL UNIT.

TABLE XXVII.
Number of hospitals and beds available.

Province	Number hospitals	Beds in hospitals	Number dispensa-ried and dressing stations	Beds in dispensa-ries	Total Beds	Beds per 1,000 popula-tion
Bahr El Ghazal ...	3	393	46	214	607	0.56
Blue Nile ...	8	1,208	157	57	1,265	0.60
Darfur ...	4	474	56	370	844	0.75
Equatoria ...	7	1,016	86	406	1,422	2.12
Kassala ...	4	713	70	213	926	1.10
Khartoum ...	6	1,081	42	24	1,105	1.94
Kordofan ...	5	704	81	499	1,203	0.53
Northern ...	6	660	98	70	730	0.88
Upper Nile ...	2	396	38	262	658	0.73
TOTAL ...	45	6,645	674	2,115	8,760	0.92

Four new hospitals were opened this year at Bor, Rufaa and Tokar and Zalinge. The work on new Singa Hospital was progressing well and foundations for Berber Hospital were laid down. The building of the Hospital at Aweil was completed but for shortage of staff it was not opened for work.

Medical Services Buildings completed during the year includes:

Province	Locality	Buildings erected
Bahr El Ghazal ...	Aweil	Hospital
" ...	Kangi	Dressing Station.
" ...	Kowajina	" "
" ...	Khor Gana	" "
Blue Nile ...	Singa	Hospital.
" " ...	Rufaa	"
" " ...	Shabarga	Dispensary.
" " ...	Shabasha	"
" " ...	Abu Haraz	"
" " ...	Sherif Yacoub	"
" " ...	Massid	Dressing Station.
" " ...	Dogabilli	" "
" " ...	Abdel Hafiz	" "
" " ...	El Rufaiat	" "
" " ...	Fazoghli	" "
" " ...	Bunzaga	" "
" " ...	Sh. El Sidig	" "
" " ...	Malaga	" "
" " ...	Wad El Agali	" "
" " ...	Abu Hamra	" "
" " ...	Rabak	" "
" " ...	Um Hani	" "
" " ...	Shikeiniba	" "
" " ...	Tayba Hassaballa	" "

Province					Locality	Buildings erected
Darfur	...	...	...	...	Zalingei	Hospital.
"	...	...	...	...	Mokjar	Dispensary.
"	...	...	...	...	Um Gafala	"
"	...	...	...	...	El Shereif	Dressing Station.
"	...	...	...	...	Abu Gabra	" "
"	...	...	...	...	El Fasher	Out patient Block.
Equatoria	...	...	...	...	Livolo	Dispensary.
"	...	...	...	...	Iwatoka	"
Kassala	...	...	...	...	Metateib Wells	"
"	...	...	...	...	Khatmia	"
"	...	...	...	...	Abu Gamol	Dressing Station.
"	...	...	...	...	Girgir	" "
Port Sudan	...	...	...	...	Tokar	Hospital.
" "	...	...	...	...	Deim Medina	Dispensary.
" "	...	...	...	...	Marafit	Dressing Station.
Khartoum	...	...	...	...	Maygoma	Health Centre.
"	...	...	...	...	Khartoum North	" "
"	...	...	...	...	Goz	" "
"	...	...	...	...	Abu Zelleng	Dispensary.
"	...	...	...	...	Kalakla	"
"	...	...	...	...	Um Dom	Dressing Station.
Kordofan	...	...	...	...	Rigl El Fula	Dispensary
"	...	...	...	...	Wad Ashana	"
"	...	...	...	...	Sunjukaiya	"
"	...	...	...	...	Um Heitan	"
"	...	...	...	...	Abeyei	"
"	...	...	...	...	Sug-El-Gamal	"
"	...	...	...	...	Eliri	" and M.A. House.
"	...	...	...	...	Mazroub	"
"	...	...	...	...	Um Kereidim	"
"	...	...	...	...	Um Garfa	"
"	...	...	...	...	Saiyala	"
"	...	...	...	...	Kagmar	"
"	...	...	...	...	Hamrat El Sheikh	"
"	...	...	...	...	El Safia	Dressing Station
"	...	...	...	...	Rahad	Wards.
"	...	...	...	...	Abu Zabad	House for M.A.
"	...	...	...	...	Muglad	" " "
Northern	...	...	...	...	Urbi	Dispensary.
"	...	...	...	...	Amentago	"
"	...	...	...	...	Salawa	"
"	...	...	...	...	Arak	"
"	...	...	...	...	Mikniya	"
"	...	...	...	...	Kaboshiya	"
"	...	...	...	...	Metamma	"
"	...	...	...	...	Kadabas	"
"	...	...	...	...	Saras	"
"	...	...	...	...	Mora	"
"	...	...	...	...	Basli	"
"	...	...	...	...	Basabir	"
"	...	...	...	...	Mahmia	"
"	...	...	...	...	Ardowan	"
"	...	...	...	...	Um Ali	Dressing Station
"	...	...	...	...	Hobagi	" "
"	...	...	...	...	Deim El Garrai	" "
Upper Nile	...	...	...	...	Ful Turuk	Dispensary
" "	...	...	...	...	Adong	Dressing Station.
" "	...	...	...	...	Agoi	" "
" "	...	...	...	...	Faweir	" "
" "	...	...	...	...	Anyidi	" "

The programme of expansion of dispensary services was maintained. Additions included :—

Province					New Dispensaries	New Dressing stations	Dispensaries Improved
Bahr El Ghazal	...	...	...	...	—	10	—
Blue Nile	...	...	...	...	1	2	—
Darfur	...	...	...	...	—	—	—
Equatoria	...	...	...	...	—	2	—
Kassala	...	...	...	...	4	3	1
Khartoum	...	...	...	...	5	—	—
Kordofan	...	...	...	...	3	2	—
Northern	...	...	...	...	7	—	2
Upper Nile	...	...	...	...	—	1	—
TOTAL					20	20	3

Dental Unit. The Senior Dental Surgeon resigned during the year and a Sudanese Dental Officer (Schools) was appointed. The number of staff during the year was two, including the new appointment.

CHAPTER VII.

MEDICAL MISSION.

Medical Missions. The work reported by medical missions is shown under :—

	In-patients	Out-patients	Operations
CHURCH MISSIONARY SOCIETY.			
Omduman (Khtm. P.)	1,869	55,754	349
Sallara (Kordofan)	23	11,168	—
Katcha (Kordofan)	446	10,007	—
Lui (Equatoria)	1,589	170,842	1,068
AMERICAN MISSION.			
Nasir (Upper Nile)	200	27,907	—
Akobo (Upper Nile)	2	4,969	—
SUDAN UNITED MISSION.			
Abri (Kordofan)	847	19,109	—
Tabaniya (Kordofan)	—	2,923	—
Sawarda (Kordofan)	130	8,748	—
Heiban (Kordofan)	3,211	11,465	—
Moro (Kordofan)	621	3,992	—
SUDAN INTERIOR MISSION.			
Pibor (Upper Nile)	12	9,154	—
Banjang (Upper Nile)	—	3,119	—
Doro (Upper Nile)	—	6,845	—
TOTAL	8,950	346,002	1,417

Medical Training.

School of Hygiene. Thirty-one students were under training of whom eleven sat for the final examination in March and all passed and received the Diploma of the Royal Sanitary Institute, England. Another batch of ten students has been taken for the first year class to complete the three classes of the school.

Seven sanitary overseers have undergone a course of 6 months training and qualified.

Twenty-one demonstrations were given to Medical students in the School. Twenty Medical Assistants : four Health Visitors : ten prison officers, fourteen Executive Officers and thirteen Military School cadets received lectures on Public Health which will equip them to solve problems that they might face when handling their duties which brings them in contact with their personnel and public.

Medical Assistants Training School. Twenty-five students were under training and sat for their final examination. Of this number twenty-one successfully passed and were qualified, the remaining four were deferred for 6 months.

Work on the new building of the School is progressing well.

Laboratory Technicians. Five are under training. They will complete their 3 years course in 1956 and 1957 respectively.

School of Dispensers. This school was closed during the year.

Radiographers. Six are under training.

Juba Training Centre.

Medical Assistants. Eight students were qualified during the year.

Lab. Assistants. Two students have completed their training and passed examination.

Sanitary Overseers. Five qualified as Sanitary Overseers.

Nurses Training School. There are twenty-nine schools in various hospitals recognised for the "in service" training. Of these eleven are for the full 3 years course and seventeen for the short one year course.

151 Mumarideen and 22 Mumaridat received their certificates during the year.

REPORT OF THE STACK MEDICAL RESEARCH LABORATORIES.

BY DR. M. A. HASEEB.

This report covers the period from July 1st. 1954 to June 30th. 1955. During this period *ad hoc* investigations were carried on Salmonella, Intestinal parasites, yellow fever, poliomyelitis and neoplasms. Summaries of these and other research activities will be found under the appropriate headings.

Among visitors to the laboratories were Sir Eric Pridie, Chief Medical Officer, Colonial Service, who came on his way to West Africa. Several points of mutual interest were discussed with him with advantage.

A group of three Doctors from the United States Naval Medical Research Unit No. 3 Cairo visited the Laboratories. The group consisted of Dr. Robert M. Dimmette, head of the Department of Pathology, Dr. H. F. Sproat, from the Pathology Department and Dr. J. Evans, from the Bio-chemistry-clinical investigation Department. They came on their return trip from Entebbe and Kampala, Uganda. Various medical topics were discussed.

The writer attended a Conference on African Onchocerciasis held by the World Health Organisation at Leopoldville in the Belgian Congo in September 1954. The Conference was held in the Conference Hall of the Princess Astrid Institute and was attended by delegates from twenty-eight interested countries.

EDUCATION AND ROUTINE ACTIVITIES.

The Southern Laboratory Assistants who started last year to come in batches of two for three-months refresher courses in the Stack Laboratories have all now been brought up to the requisite standard and sent back to their respective stations. Two more laboratory Assistants from the South are undergoing training in laboratory technique for the Church Missionary Society.

Twelve laboratory assistants had been trained on advanced laboratory technique including the Kahn test during the year. It has also been possible to give training to one of the staff of the Veterinary School of Khartoum University College.

Two laboratory assistants were detailed for special duties: one to carry out a survey on Kala Azar in the Singa-Sennar area and the other to examine blood films for Malarial parasites in the Northern Province as recommended by Dr. Mara the W.H.O. expert malariologist.

As usual the teaching of academic and practical bacteriology to the Medical students in the Faculty of Medicine, Khartoum University College and also the teaching of Forensic Medicine to the same students and to the cadets of the Sudan Police College have made heavy demands on the time of the Laboratory Staff.

TECHNICIANS' CLASS.

The class was augmented by a fifth candidate from the Secondary Schools. Of the total five students three have now completed their training in media-making, biochemistry, haematology and bacteriology and have successfully passed the examinations on these subjects. Their training has been interrupted because of the retirement on pension of their teacher, but efforts are being made to recruit a suitable teacher to resume training as soon as possible. The other two students have completed their training in media-making, biochemistry and haematology and have successfully passed the examination on these subjects but they have yet to do two more years.

The last year of the course is devoted entirely to histopathology, mounting of museum specimens, microphotography and medico-legal work.

This new enterprise of training technicians locally seems so far to be promising. It should however be emphasised that it is essential to start with good material, because it is impossible to make a silk purse from cheap calico.

A summary of the work and examinations carried out during the period under review is appended to the report. The total number of examinations was 3,1703 as compared with 34,452 in the previous year and 31,147 in 1952/53 year. Although there is no total increase in the number of examinations done yet there is a definite relative increase in such tests that require longer time to perform *e.g.* biochemical and antibiotic sensitivity tests.

Histopathological work of rather highly specialised routine continued to increase and demands for the examination for fertility of endometrial curettings and biopsies from testes became common.

The issue of lymph vaccine increased from 1,571,140 doses last year to 2,731,080 doses this year.

POST—MORTEM EXAMINATION.

36 Postmortem examinations were performed in Khartoum Civil Hospital in the year under review. Of these 19 were medico-legal.

PATHOLOGICAL SPECIMENS.

The total was 836 excluding brains for rabies, the total for the previous year was 1,106.

NEOPLASMS.

116 neoplosms were received of which the folloing table is a summary :—

TABLE.
Malignant Tumours.

Site					Carcinoma	Sarcoma	Melanoma	Mixed	Total
Scalp	...	...	...	...	11	—	—	—	11
Jaw	...	...	...	...	7	—	—	—	7
Face	...	...	...	...	3	1	—	—	4
Brain	...	...	...	...	1	—	—	—	1
Tongue	...	...	...	...	2	1	—	—	3
Mouth	...	...	...	...	4	—	—	3	7
Eye	...	...	...	...	7	2	—	—	9
Neck	...	...	...	...	7	—	—	—	7
Thyroid	...	...	...	...	3	—	—	—	3
Parotid	...	...	...	...	1	3	—	3	7
Chest	...	...	...	...	—	1	—	—	1
Shoulder	...	...	...	...	2	—	—	—	2
Arm	...	...	...	...	—	3	1	—	4
Back	...	...	...	...	1	—	—	—	1
Leg	...	...	...	...	5	2	—	—	7
Foot	...	...	...	...	1	2	11	—	14
Buttocks	...	...	...	...	2	—	—	—	2
Abdomen	...	...	...	...	4	1	—	—	5
Intestine	...	...	...	...	2	—	—	—	2
Mesentry	...	...	...	...	—	—	—	—	—
Liver	...	...	...	...	3	—	—	—	3
Bladder	...	...	...	...	6	—	—	—	6
Kidney	...	...	...	...	1	1	—	—	2
Groin	...	...	...	...	—	1	—	—	1
Scrotum	...	...	...	...	—	1	—	—	1
Penis	...	...	...	...	1	—	—	—	1
Prostate	...	...	...	...	4	—	—	1	5
TOTAL					78	19	12	7	116

Prof. B. B. Hickey has conducted a survey of the malignant epiplastic tumours received in the Stack Medical Research Laboratories from 1935—1953.

A detailed study has been undertaken and will form the subject of a further publication.

The number of growths according to site and frequency are as below in order of frequency :—

Site						Number	Remarks			
Skin	393	Comprising :	Epitheliomata	284	
								Melanomata	108	
								Rodent-Ulcer	45	
Breast	306	Comprising :	44 Adeno-Carcinomata of Rection		
Rectum and Anus	...	...	...	...	...	67
								22 Squamons carcinoma		
								1 melanoma of Anal		
Salivary Glands	56	Comprising :	"miscad "	47	
								barinoma	9	
Bladder	54				
Mouth including lips	...	...	...	...	...	51
Abdominal	...	...	...	...	...	45
Vagina	...	...	...	...	...	38
Liver	...	...	...	...	...	38
Penis	...	...	...	...	...	26
Ovary	...	...	...	...	...	23
Thyroid	...	...	...	...	...	19
Prostate	...	...	...	...	...	18
Testis	...	...	...	...	...	16
Tongue	...	...	...	...	...	7
Intestine	...	...	...	...	...	7
Stomach	...	...	...	...	...	5
Oesophagus	...	...	...	...	...	1

Ovary	...	...	...	...	5	—	—	—	5
Uterus	...	...	...	...	3	—	—	—	3
Vagina	...	...	...	...	3	—	—	—	3
Cervix	...	...	...	...	23	—	—	—	23
Breast	...	...	...	...	24	—	—	—	24
Lymph gland	...	...	...	...	10	4	1	1	16
Skin	...	...	...	...	6	—	—	—	6
Unspecified	...	...	...	...	6	1	—	—	7
Bone	...	...	...	...	—	—	—	—	—
Rectum	...	...	...	...	8	—	—	—	8
Peritoneum	...	...	...	...	—	2	—	—	2
Thigh	...	...	...	...	1	—	—	—	1
Hand	...	...	...	...	1	—	1	—	2
TOTAL					90	7	2	1	100

RABIES.

302 brains were received of which 23 were decomposed and useless for examination. 70 of the remaining 209 were positive for Negri bodies. This contrasts with 83 positive out of 297 brains received last year. The decrease is probably due to the fact that registration, licencing and vaccination of dogs became compulsory.

The species and distribution of positives and negatives in the present years series is shown in the following table :—

TABLE.
Rabies Examination.

Animal	Positive	Negative	Decomposed	Total
Dog	55	176	18	249
Donkey	5	8	3	16
Cat	1	12	—	13
Goat	5	1	—	6
Cow	—	1	—	1
Horse	—	1	1	2
Camel	—	2	1	3
Leopard Cub	—	2	—	2
Calf	2	2	—	4
Monkey	—	3	—	3
Human	2	—	—	2
Rabbit	—	1	—	1
TOTAL	70	209	23	302

The smear method and Seller's stain for diagnosis of rabies was continued on all fresh brains received for sectioning. The method remained to give satisfactory results. Research and routine work on rabies by the staff of these laboratories during the years 1935—1949 was published by Kirk, Haseeb and MacKinnon (Journal of the Sudan Medical Association (1935) 3, 5). During this period the writers were concerned with the laboratory diagnosis, preparation and issue of vaccine and occasionally with management and disposal of actual material in suspected cases of rabies.

RABIES VACCINE.

40,900 mls. were issued this year compared with 293,625 mls. issued last year. The amount issued this year is sufficient to treat 5,842 cases. Owing to the fact that antirabic treatment is decentralised and that the vaccine is issued out to the various hospitals in the Provinces on demand, a certain amount of waste is bound to take place.

LYMPH VACCINE.

Research. The experiment that had been started last year on infecting monkeys by the intranasal route with small-pox to study the pathogenesis of the disease was unfortunately interrupted because of shortage of material. It is intended to resume the experiment when material is available.

Routine. 132 sheep were used for the product of 9,171 grams. of pulp with an average yield of 69.4 grams. per sheep.

YELLOW FEVER.

There is an acceptable explanation for the persistence of the yellow fever virus in the extensive rain-forests in Africa and South America. Effective vectors and susceptible vertebrates have been identified. Both occur throughout the

year in adequate numbers to explain the maintenance of the virus in cyclic passage, probably in the form of wandering epizootic, but the extension of yellow fever and particularly its manner of persistence in zones beyond the confinement of rain-forests in Africa, are not clear. The climatic and biological environments in these zones may vary widely from those of the rain-forests. This applies to both mosquito and primate fauna. Thus the explanation which has been offered for the persistence of the virus in the rain-forests becomes invalid or inadequate; at least the same species of mosquito and primate are not equally and consistently involved. The Southern Provinces of the Sudan are a case in point.

The results of the reconnaissance on yellow fever carried out by Dr. R. M. Taylor, Head of the Department of Virology, United States Naval Medical Research Unit No. 3, Cairo, Dr. T. A. Work, Staff Member, Division of Medicine and Public Health, Rockefeller Foundation, New York and the present writer were published in the Bulletin of the World Health Organization (Taylor, Haseeb and Work, 1955, 12, 711-725). Neutralisation tests with yellow fever virus performed on 666 human sera collected in the Southern Sudan imply that yellow fever is still endemic South of the 10th. parallel, in the South-West border of the Nuba Mountains, and in the plains west of the Nuba Mountains as far North as El Muglad. Similar tests on bloods from 110 primates revealed a high rate of immunity among both baboons (*papio Sp.*) (94%) and grivet monkeys (*Cercopithecus aethiops*) (77%) and a very low rate (1 in 56) among galagos (*Galgo senegalensis*). It would therefore appear that, in contrast to the baboon and grivet monkey, the galago is not significantly involved in the cycle of the virus. The finding of only one out of 56 galagos giving a definite immune reaction, combined with the 10 negatives recorded by Kirk and Haseeb (1953) implies that this animal is not an important host of yellow fever virus in the Sudan. The same may be concluded, on the basis of Bugher's experience, for West Africa (1951). It would seem, therefore, that while the *Galago crassicaudatus lasiotis* may be the principal vertebrate host in Kenya, *Galago senegalensis* does not play a similar role in the Sudan and West Africa. If the species of *Galago* native to the Sudan is not involved, then some other explanation must be thought for the persistence of the virus. The pattern of immunity in man is not indicative of a purely man-to-man transmission by a domiciliary mosquito vector, nor is the number of monkeys and baboons sufficient to support alone the continuation of the infection. However, it is conceivable that, with man, monkeys and baboons serving jointly as vertebrate hosts, in combination with a mosquito vector that attacks all three, the cycle of the virus might be maintained. This concept is plausible only because of the climatic conditions, and the rather peculiar habits and movements of the people in the western plains. The Baggara people lead a nomadic life wedded to their herds and the long dry season drives them, their cattle and the primates to the vicinity of water-holes of Wadis. It is conceivable, therefore, that with a shifting human population and with the bands of grivet monkeys around the Wadis, the chain of yellow fever virus is kept intact.

Obviously further investigation is required to prove or disprove this hypothesis. Further studies should be concentrated upon the Baggara tribes and the mosquito vectors around the Wadis during the dry season.

PHAGE-TYPING OF *SALM. TYPHI*.

Enteric fevers continued to occur in various places of the country. Whenever the balance is tipped in favour of the organism as a result of slacking in general sanitary measures a small outbreak of enteric infection creeps up. In these days of fast communications it is of considerable importance to be able to detect the origin of infection and whenever possible such an attempt should be made. The phage-typing method of *Salm. typhi* is one way of doing so. Strains had therefore

been collected from various parts of the country and through the kind help of Dr. E. S. Anderson, Director of the Central Enteric Reference Laboratory Bureau, Colindale, London, were typed. The investigation is continued. The following table gives the results of Phage-typing of *Salm. typhi* of the first 31 cases :—

TABLE.

Locality							No. Strains Typed	VI-Phage Type.
Atbara	...	...	...	...	...	...	4	1 O 1 G 2 El
Abu Usher	...	...	...	...	...	...	2	1 G 1 El
Khartoum	...	...	...	...	...	...	4	1 D1 1 El 2 Degrad. Vi-strain
Omdurman	...	...	...	...	...	...	1	1 C1
Kassala	...	...	...	...	...	...	1	1 El
Wadi Medani	...	...	...	...	...	...	3	3 El
Dueim	...	...	...	...	...	...	1	1 El
Kosti	...	...	...	...	...	...	1	1 El
Dongola	...	...	...	...	...	...	1	C
Rufaa	...	...	...	...	...	...	1	Degrad. Vi-strain
Port Sudan	...	...	...	...	...	...	1	1 El
El Fasher	...	...	...	...	...	...	1	A
Sennar	...	...	...	...	...	...	3	2 A 1 Untyphable Vi-strain
Malakal	...	...	...	...	...	...	1	Degrad. Vi-strain
Gedaref	...	...	...	...	...	...	1	C
Wadi Halfa	...	...	...	...	...	...	5	3 C 1 Degrad. Vi-strain

The designation 'degraded Vi Strain,' refers to a particular pattern which some cultures give with the typing phages which makes it impossible to assign them to a specific type. Such cultures are often fully virulent, of course.

As far as frequency of occurrence of the various types are concerned, type El is commonest throughout the world today, and type C is about the third commonest Vi-phage type. Type D1 is relatively common and type D is rather rare. Type G is also rare but occurs in various parts of Africa.

Enteric fever due to Salm. Thompson.

Salm Thompson was isolated from the blood of a patient in Khartoum Civil Hospital showing signs and symptoms suggestive of Enteric infection. There was no suspicion of food poisoning. *Salm. Thompson* is very common in Great Britain where it is about the third most frequent Salmonella type met with in outbreaks of food poisoning (Topley and Wilson, 1955, 1, 895). As far as the author is aware *Salm-thompson* has not been incriminated in enteric infections before.

Immunisation against Enteric fevers by the Intradermal route :

T.A.B. vaccine engenders immune bodies whether injected intravenously, intra-muscularly, subcutaneously or intradermally, but there are great differences between the resultant reactions of the human body to the sudden introduction of this toxic foreign protein at various sites. The usually recommended subcutaneous method is followed by local and general reactions which can be quite severe.

Tuft (1931), however, considered immunisation by the intradermal route and postulated that the marked antibodies response thus obtained, using one tenth of the amount of T.A.B. vaccine usually used with the subcutaneous method, could best be explained on the basis that a more powerful stimulation occurred of the cells of the reticulo-endothelial system. He further found that both local and general reactions were much reduced. Tuft (1940) and others (Pai, 1947) confirmed by mouse protection tests the formation of adequate protective antibodies when T.A.B. vaccine is injected intradermally in 0.1 to 0.2 mc. amounts. The intradermal route was used in the Federation of Malaya with good results.

A comparatively small experiment was started in Khartoum with the help of the Province Medical Officer of Health to assess the rise in titre three weeks after T.A.B. immunisation with the intradermal route. Blood was collected at the time of giving the inoculation and again three weeks later. The inoculation consisted of 0.1 ml. of standard T.A.B. vaccine given intradermally in the left forearm. The following table represents the titres before and after inoculation in seventeen cases and immunised by the intradermal routes contrasted with twelve cases immunised by the subcutaneous method :

TABLE.

No.	Inocu- lation Route	TITRE OF THE PATIENT SERUM									
		Before Inoculation					After Inoculation				
		H	O	A	B	M	H	O	A	B	M
1	I.D	1/50	1/50	—	—	—	1/250	—	—	—	—
2	I.D	—	—	—	—	—	1/125	—	—	—	—
3	I.D	—	1/25	—	—	—	—	—	—	—	—
4	I.D	—	—	—	—	—	1/125	—	—	—	—
5	S	1/50	1/50	—	—	—	1/250	—	—	—	—
6	S	1/50	1/29	—	—	—	1/250	—	—	—	—
7	I.D	—	—	—	—	—	1/250	1/25	—	—	—
8	I.D	—	—	—	—	—	1/125	—	—	—	—
9	I.D	1/25	1/25	—	—	—	1/50	—	—	—	—
10	I.D	—	—	—	—	—	1/250	—	—	—	—
11	I.D	1/25	—	—	1/25	—	1/50	1/50	—	—	—
12	I.D	1/250	1/50	—	—	—	1/250	1/250	—	—	—

No.	Inoculation Route	TITRE OF THE PATIENT SERUM									
		Before Inoculation					After Inoculation				
		H	O	A	B	M	H	O	A	B	M
13	I.D	—	—	—	—	—	1/250	1/50	—	—	—
14	I.D	—	—	—	—	—	1/250	—	—	—	—
15	S	—	—	—	—	—	1/250	—	—	—	—
16	S	—	—	—	—	—	1/250	1/25	—	—	—
17	S	—	—	—	—	—	1/250	1/125	—	—	—
18	I.D	—	—	—	—	—	1/250	1/50	—	—	—
19	S	1/50	1/25	—	—	—	1/250	1/125	—	—	—
20	I.D	—	—	—	—	—	1/250	1/25	—	—	—
21	S	—	—	—	—	—	1/250	1/50	—	—	—
22	S	1/25	1/50	—	—	—	1/250	1/125	—	—	—
23	I.D	—	—	—	—	—	1/250	1/25	—	—	—
24	S	—	—	—	—	—	1/250	—	—	—	—
25	S	1/25	1/25	—	—	—	1/250	1/125	—	—	—
26	I.D	1/25	1/25	—	—	—	1/250	1/50	—	—	—
27	S	1/50	1/50	—	—	—	1/250	1/250	—	—	—
28	S	—	—	—	—	—	1/50	—	—	—	—
29	I.D	—	—	—	—	—	1/250	1/125	—	—	—

I.D = Intradermal route.

S. = Subcutaneous.

INTESTINAL AND URINARY PARASITES IN THE SUDAN.

An attempt has been made to carry out a survey on intestinal and urinary parasites in School children (aged 7-12 years) in Khartoum Province. Single specimens of urine and faeces were collected from each school child and brought immediately to the laboratories to be examined without delay. An average of ten urines and ten faeces were examined daily. The examinations were made independently by three workers and the findings were confirmed by all three. The urines were examined for albumin and after centrifugation the deposits were examined microscopically for cells, casts, ova or crystals.

In the case of the faeces each specimen was examined by four different methods :

1. Direct smear : A small specimen of the stools was thoroughly emulsified in saline by means of an applicator. The smear was made of such thickness that news print was just legible through it. A cover-glass is applied and the preparation was examined systematically under the low-power of a compound microscope and when necessary under the high-power lens.
2. Stained smear : A preparation similar to the above was made but instead of saline Gram iodine was used for emulsifying the specimen.
3. Floation method : About 1 gram of faeces is thoroughly emulsified in a small amount of zinc sulphate solution (331 Grms. Zn. SO₄ in 1 litre water. Sp. gr. 1.180) in a glass test-tube. More zinc sulphate solution is added until it fills the test-tube to the brim. A slide is then placed over the tube touching the meniscus of the solution. After from 10 to 30 minutes the slide is removed, a cover glass is applied and the preparation is examined.

4. Sedimentation: The faecal specimen is thoroughly mixed in 2% formol-saline until its consistency is about that of a thin paste. This is then put in a conical, urine-glass and from about 10—20 times its value of formol-saline is added to it and allowed to stand. After one hour the top three-fourths is poured off, the urine-glass is filled with formol-saline, stirred throughout and allowed to stand again. This process is repeated three times. Then portions of the sediment are removed by a pipette and examined under the microscope.

The following tables give a summary of the results of the 440 specimens of urine and faeces examined so far. However the investigation is continued :

TABLE.
RESULTS OF 440 SPECIMENS OF FAECES FROM HILLA GADID
SCHOOL CHILDREN (AGED 7—12 YEARS).

Parasites Found	Direct Smear	Strain Smear	Floation	Sedimen-tation.
<i>Hymenolepis Nana</i> Ova	55	55	75	65
<i>Giardia lamblia</i> Cyst.	100	100	59	84
<i>T. Saginata</i> Ova	1	1	1	1
<i>Oxyuris vermicular's</i>	3	—	—	—
<i>Ancylostoma.</i> Ova	1	1	3	4
<i>Flagellates</i>	30	—	—	—
<i>E. histolytica</i> Cyst	2	2	—	—

N.B. Of the 440 faeces examined 225 were negative for intestinal parasites and of 1760 examinations made 1117 were negative for intestinal parasites.

Results of 440 urines for Hilla Gadida School children (aged 7—12 years) :—

Albumin	...	...	....	...	...	—	22
<i>S. haematobin</i>	...	...	...	...	...	—	1
Negative	...	...	...	...	...	—	417
TOTAL	...	...	...	...	...	—	440

Intestinal parasites in Bahr El Ghazal Province :

A cursory survey of intestinal parasites of natives living in the South-west Sudan was carried out by Kuntz, Lawless and Mansour, of the Unites States Naval Medical Research Unit No. 3 Cairo, (American journal of Tropical Medicine and Hygiene (1955), Vol. 4, Number 895, 5). Single specimens from 79 persons were examined. The greater number of the specimens was obtained at Wau Civil Hos-pital from out-patients who had come to the clinic for treatment of wounds, fevers and other general ailments. Dinkas, Nuers, Jurs and Zandes were represented in the series. Over 75—of the persons examined were males (aged 13—51 years).

Faecal samples were fixed by the ‘M.I.F.’ method of Sapero and Lawless (1953) and examined by the usual direct smear method and also by brine floation method.

The results of this survey is summarised in the following table :

TABLE.
INCIDENCE OF INTESTINAL PARASITES RECORDED FROM
FAECAL SAMPLES OF NATIVES LIVING IN THE
SOUTH-WEST SUDAN.

Protozoa :									
<i>Endamoeba hystolitica</i>	(1 large race)	...	...	...	...	...	...	...	15
„	„	(Small race)	...	...	...	...	...	...	43
„	„	(Both small and large race)	...	...	...	...	...	...	9
<i>Endamoeba coli</i>	...	...	...	...	...	...	...	...	49
<i>Indoimax nan</i>	...	...	...	...	...	...	...	...	43
<i>Dientamoeba fragilis</i>	...	...	...	...	...	...	...	...	1
<i>Iodamoeba butschli</i>	...	...	...	...	...	...	...	...	13
<i>Chilomastix mesnili</i>	...	...	...	...	...	...	...	...	8
<i>Enteromonas hominis</i>	...	...	...	...	...	...	...	...	5
<i>Giardia lamblia</i>	...	...	...	...	...	...	...	...	10
<i>Trichomonas hominis</i>	...	...	...	...	...	...	...	...	1
<i>Isospora</i>	...	...	...	...	...	...	...	...	1
Helminths :									
<i>Ancylostoma</i>	...	...	...	...	...	...	...	...	23
<i>Ascaris lumbricoides</i>	...	...	...	...	...	...	...	...	none
<i>Enterobius vermicularis</i>	...	...	...	...	...	...	...	...	1
<i>Trichostrongylus</i>	...	...	...	...	...	...	...	...	2
<i>Trichuris trichiura</i>	...	...	...	...	...	...	...	...	1
<i>Hymenolepsis nana</i>	...	...	...	...	...	...	...	...	1
<i>Taenia saginata</i>	...	...	...	...	...	...	...	...	none
<i>Schistosoma mansoni</i>	...	...	...	...	...	...	...	...	10
Specimens with no protozoa	...	...	...	...	...	...	...	...	24
Specimens with no helminths	...	...	...	...	...	...	...	...	57
Specimens neither protozoa nor helminths	...	...	...	...	...	...	...	...	10
Total number of faecal specimens examined	...	...	...	...	...	...	...	...	79

Of the 79 specimens examined 67% and 1%, respectively, were infected with *Endamoeba hystolitica* and *Dientamoeba fragilis*, 5% with *Enteromonas hominis* and there was one infection with *Isospora*. Eggs of *Ancylostoma* and *Trichostrongylus* were recorded in three per cent and two per cent respectively. Eggs of *Schistosoma mansoni* were detected in 10 per cent of the stools. There was a single case of infection with *Trichuris* and one with *hymenolepsis*.

POLIOMYELITIS.

Recent progress in Poliomyelitis research has culminated, after a decade of work, in the developement of a useful vaccine to combat paralysis. The Salk vaccine is an aqueous suspension of an inactivated poliomyelitis virus prepared from a selected strain of each of the three virus types grown on monkey kidney cells. The formaldehyde inactivation is designed to render the virus harmless, while preserving its capacity to induce production of antibodies.

Clinical observations indicate that poliomyelitis shows seasonal activity among young children in the Sudan. Such observations were confirmed by the Upper Nile Province small survey carried out in 1953. However it was felt that a comparatively large scale survey should be initiated before a conclusion is reached whether vaccination is required or not. Dr. J. H. S. Gear, Director of Research of the South African Poliomyelitis Research Foundation was approached and he kindly consented to test sera from the Sudan. 50 sera were collected from children up to the age of 15 in Khartoum and an equal number from the same age-group of children living in Kassala Town. The specimens included about ten from each age-group—1, 1—2, 2—3, 3—5, 6—10, 11—15 years.

The results of the tests are not yet to hand.

BLOOD.

Following the work of Foy and Kondy (1954) a search for abnormal haemoglobin in some Southern Sudanese peoples was undertaken by D. F. Roberts and H. Lehmann (B.M.J. 1955, 1, 519). No abnormal haemoglobin was discovered by paper electrophoresis of 75 blood specimens from Northern Nilotes of the Sudan. In 739 specimens examined no sickling was found and since in no individual of this large sample was the sickle-cell trait observed, it is concluded that the absence of the trait is a characteristic typical of the Nilotic peoples of the Sudan. This finding is similar to that of Foy *et al* (1954).

MAMMALS OF THE SUDAN.

The distribution and taxonomy of mammals in the Sudan are poorly known. A report on mammals was compiled by NAMRU consultant Henry W. Setzer, Associate Curator of Mammals at the United States National Museum, and accepted for publication in *Fieldiana, zoology*, 1956. This report, which does not include bats, includes the taxonomic status and distribution of some 90 genera and 225 species and sub-species of non-chiropteran land mammals, of which 23 are described as new.

MADUROMYCOSIS.

The name Maduromycosis was suggested by Chalmers and Archibald (1916) for mycetomas caused by fungi in distinction from those caused by *Actinomyces*. Since that time very little work has been done on mycetomas in the Sudan. This year an important contribution on the study of the casual organisms of maduromycosis was made by Dr. Juan E. Mackinnon, of the Instituto de Higiene Facultad de Medicina, Montevideo, Uruguay (Trans. Roy. Soc. Trop. Med. and Hyg., 1954 Vol. 48, No. 6, 470).

Of 47 strains isolated from cases of maduromycosis in the Sudan, 46 were identified as *Madurella Mycetomi*. The macroscopic, microscopic and biological properties of these organisms were discussed in detail by Mackinnon.

SUMMARY OF ROUTINE EXAMINATIONS.

From 1st. July 1954 to 30th. June 1955.

Kahn tests	...	...	...	...	...	...	...	...	...	...	16,779
Widals	...	...	...	...	...	...	...	...	...	...	2,197
Weil-Felix	...	...	...	...	...	...	...	...	...	...	7
Heterophile agglutination (Paul Bunnel)	...	...	...	...	...	...	...	...	...	...	19
Blood cultures	...	...	...	...	...	...	...	...	...	...	1,246
Blood Films	...	...	...	...	...	...	...	...	...	...	1,651
Blood counts	...	...	...	...	...	...	...	...	...	...	328
C.S. Fluids	...	...	...	...	...	...	...	...	...	...	180
Medico-legal (Blood and Seminal stains)	...	...	...	...	...	...	...	...	...	...	73
Biochemical tests	...	...	...	...	...	...	...	...	...	...	986
Autogenous vaccines	...	...	...	...	...	...	...	...	...	...	2
Pathological Histology (including rabies)	...	...	...	...	...	...	...	...	...	...	1,138
Faeces	...	...	...	...	...	...	...	...	...	...	2,236
Urine	...	...	...	...	...	...	...	...	...	...	1,527
Throat and Nasal swabs for C. diphtheria	positive	...	...	...	...	...	...	...	...	...	97
„ „ „ „ „ „ „	negative	...	...	...	...	...	...	...	...	...	1,713
Sputum for Myco tuberculosis	positive	...	...	...	...	...	...	...	...	...	19
„ „ „ „ „	negative	...	...	...	...	...	...	...	...	...	138
General Bacteriological examinations	...	...	...	...	...	...	...	...	...	...	1,160
Water tests	...	...	...	...	...	...	...	...	...	...	207
TOTAL											31,703

Summary of Faeces Examinations.

<i>Shigella flexneri</i> V—Z	...	...	...	...	...	...	66
<i>Shigella shigae</i>	...	...	...	...	...	...	14
<i>Shigella schmitz</i>	...	...	...	...	...	...	2
<i>S. Typhi</i>	...	...	...	...	...	...	29
<i>S. paratyphi</i> A.	...	...	...	...	...	...	2
<i>Entamoeba histolytica</i>	...	...	...	...	...	...	9
Ova present	...	...	...	...	...	...	11
Negative	...	...	...	...	...	...	2,103

Summary of Urine Examinations.

<i>S. typhi</i>	6
Negative	...	...	...	...	...	...	1,521

Summary of Kahn Tests.

Positive	...	...	...	...	...	...	...	...	3,063
Negative	...	...	...	...	...	...	...	...	13,716

Summary of Blood Films.

Benign tertian Malaria	13
Subtertian Malaria	197
Negative	1,438

Kala-azar.

Positive	3
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Summary of Widal Reaction.

<i>S. typhi</i>	334
<i>S. paratyphi</i> A.	1
<i>S. paratyphi</i> B.	2
<i>Br. Melitensis</i>	69
Negative	...	...	...	...	...	...	...	1,791

Summary of Blood Cultures.

<i>S. typhi</i> isolated	101
<i>S. paratyphi</i> A. isolated	...	...	...	...	...	...	...	9
<i>Br. Melitensis</i> isolated	...	...	...	...	...	...	...	2
<i>Streptococcus pyogenes</i> isolated	...	...	...	...	...	...	...	6
Other organisms isolated	...	...	...	...	...	...	...	23
Negative	...	...	...	...	...	...	...	1,105

Summary of Heterophile Agglutination Tests.

Positive	1
Negative	18

Summary of Well-Felix Reactions.

Negative	7
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Summary of Vaccines Issued.

T.A.B. vaccine	466,200	ml.
Anti-rabic vaccine	40,900	ml.
Cholera vaccine	...	...	...	...	...	...	...	50,900	ml.
Lymph vaccine	...	...	...	...	...	...	...	2,731,080	doses

APPENDIX "O".

LIST OF PUBLICATIONS DURING THE YEAR BY MEMBERS OF THE STAFF.

Name and initials of Author	Date of Publication	Title of Article	Title of Journal in which published	Volume number of Journal	Page number. of Journal
Haseeb, M. A.	1954	Tuberculin survey in the Sudan.	Journal of Trop. Med. and Hygiene	Vol. 57, No. 10	234 — 238
Haseeb, M. A.	1954	Onchocerciasis in the Sudan.	A paper read in the W.H.O. Conference on Onchocerciasis in Leopoldville, September, 1954.		
Haseeb, M. A. and Holder, J. ...	1955	The level of natural sheep cell agglutinations in the Sudan.	Journal of Trop. Med. and Hygiene.	53, No. 4	85
Haseeb, M. A.	1955 In the Press.	The joint C.C.T.A. W.H.O. Training Course on Rabies at Muguga.	Sudan Med. Journal		
Kirk, R. and Haseeb, M. A. ...	1955	Observations of Rabies in the Sudan.	Sudan Med. Journal	Vol. I, No. 3.	5
Taylor, R. M., Haseeb, M. A. and Work, J. H.	1955	A regional reconnaissance on Yellow Fever in Sudan.	Bull. of the W.H. Org.	12	711 — 725

**ANNUAL REPORT OF THE
GOVERNMENT ANALYST.**

This report refers to the work carried out at the Wellcome Chemical Laboratories during the year ending 30th. June 1955.

STAFF.

Mr. D. N. Grindley F. R. I. C., Government Analyst, retired from Government service during the year, after 17 years service in the Sudan.

Abdel Hamid Eff. Ibrahim Suleiman B.Sc. continued his studies at the Imperial College, London, where he is studying for an M.Sc. degree.

AYALYTICAL REPORT.

The following samples were received during the year, last year's figures are given for comparison :—

	1954/55	1953/54
Waters	254	291
Foods	270	202
Drugs	17	240
Clinical Specimens	17	22
Toxicological Specimens	136	118
Forensic Specimens	6	7
Mineralogical Specimens	53	63
Commercial Seeds and Oilcakes	319	309
Damaged Materials	161	38
Soaps	10	3
Gums	303	139
Miscellaneous	66	99
TOTAL	1612	1531

2. Of these samples, 608 came from commercial firms, 368 from the Ministry of Health, 299 from the Ministry of Agriculture, 112 from the Ministry of Works, 51 from the Sudan Police and 174 from other sources.

The accounts rendered for analysis during the year amounted to £E. 1760 compared with £E. 946 last year.

WATERS.

Of the 254 samples received, 110 came from the Drilling Engineer, Ministry of Works from new wells and bores sunk by his section. Thirty samples were from the Sudan Gezira Board, from their supplies at Barakat, and forty samples came from wells near Suakin that are used during the pilgrimage to Mecca.

Routine boron estimations are now done on all waters that are likely to be used for irrigation. The presence of more than slight traces of boron can be very toxic to plant growth.

FOODS.

270 samples of food were received, of these, 105 were for the purpose of detecting adulteration contrary to the provisions of the Sudan Penal Code.—The following is a summary of the results of the analyses of Penal Code samples :

Description	Number of samples	Number adulterated	Percentage of samples adulterated
Milk	57	20	35
Milk—Appeal-to-Cow	14	—	—
Coffee	25	12	48
Butterfat	4	3	75
Sugar	2	2	100
Tea	3	0	0

Hitherto, the only foodstuff that has been systematically tested for adulteration has been milk ; even with this commodity, the proportion of samples adulterated is astonishingly high. Adulteration of milk this year was caused by the addition of water in amounts varying from 5 to 52%.

It has been suspected for some time that other foodstuffs on sale in Khartoum must be adulterated, but it was not until late this year that steps were taken by these laboratories to discover the extent of food adulteration in Khartoum. Samples of coffee and butterfat were purchased by members of the staff, to initiate this survey, and as a result of the analyses, the co-operation of the Province Medical Officer of Health, the Senior Public Health Inspector and the Police were obtained in procuring further samples. The results of six weeks' work in foodstuffs other than milk are shown in the table above.

All the samples of adulterated coffee contained about 50% barley, and came from different shops supplied by the same wholesaler who claimed that he made the adulteration with the knowledge and consent of the retailers.

The adulterated butterfats had been mixed with varying proportions of foreign oils (groundnut and sesame oils).

The adulterated sugars came from the same retailer and were found to be mixed with salt (8% and 14% respectively).

These findings give no grounds for complacency. The high percentages of adulteration in nearly all commodities examined show that there is a great need for more effective enforcement of the sections of the Sudan Penal Code which deal with adulteration of foods. This need will increase in the coming months as the new Weights and Measures Ordinance is enforced, since dishonest traders will seek to maintain their illicit profits by adulteration when they are prevented from giving short weight. The existing statute is sufficient to prevent the grosser forms of adulteration, and co-operation has been obtained with the Police, the Province Medical Officer of Health, and the Senior Public Health Inspector for more effective enforcement. Later further statutes may be necessary to prevent false and misleading descriptions.

Other foodstuffs included commercial seed oils, butterfats, squashes etc. for various analyses.

DRUGS.

Seventeen samples were examined for purity and for compliance with Pharmacopoeial specifications. One sample of injection of planocaine which had caused severe toxic symptoms was found to be decomposed.

As in the case of foodstuffs, the time has come for a programme of sampling to detect adulteration of drugs, contrary to the provisions of the Sudan Penal Code. Hitherto, very little has been done to enforce the law. In addition to the possibilities of adulteration, there is also the probability that many drugs sold to the public are of little or no value, because they have decomposed after long storage; some may even be harmful because of the formation of toxic decomposition products.

It is hoped that the coming year will see the initiation of a survey similar to that already started for foodstuffs.

CLINICAL SPECIMENS.

During the year, 17 samples were received, which consisted of 11 stools, 1 calculus, 4 bloods and 1 serum.

TOXICOLOGICAL SPECIMENS.

136 samples were placed in this category, and included the following interesting cases.

(a) Human Viscera.

- (i) 2 cases of strychnine poisoning ;
- (ii) 1 case of opium poisoning ;
- (iii) 1 case of zinc poisoning ;
- (iv) 2 cases of alcohol poisoning ;
- (v) 1 case of bismuth poisoning ;

(b) Animal Viscera.

- 2 cases of arsenic poisoning ;

(c) Plant Materials.

- (i) 5 samples of hashish ;
- (ii) 1 sample of opium ;
- (iii) 1 sample of dura containing arsenic ;
- (iv) 1 sample of sugar containing strychnine.

FORENSIC SPECIMENS.

These consisted of 3 forged documents, 2 samples of adulterated petrol, and a sample of string submitted in a case of suspected arson.

MINERALOGICAL SPECIMENS.

The 53 samples submitted included 5 samples of coal, 7 samples of soil, 3 samples of household paraffin, 2 samples of cement and 36 minerals of various kinds.

COMMERCIAL SEEDS AND OILCAKES.

The following were submitted for analysis ;

Cottonseeds	...	...	...	...	...	...	141
Groundnuts	...	...	...	...	...	...	14
Sesame Seeds	...	...	...	...	...	...	14
Melonseed	...	...	...	...	...	...	1
Lubia	...	...	...	...	...	...	1
Oilcakes	...	...	...	...	...	...	148
TOTAL	...	...	...	...	...	...	319

DAMAGED MATERIALS.

All of the samples in this section are submitted in connection with insurance claims for damage to goods in transit. There has been a significant rise in the number of samples submitted from 38 last year to 161 this year.

SOAPS.

All 10 samples were submitted as tenders for the supply of soap to the Ministry of Stores and Equipment.

GUMS.

303 samples of gum were received, 241 of which were received from the Silviculturist and which are discussed in the Research Report. The remainder were from commercial firms for determination of impurities.

MISCELLANEOUS SAMPLES.

Included in this category are samples of perfume (6), bat guano (7), composts (5), blankets (4), cigarettes (1), insecticides (4), and chlorinated lime (3).

RESEARCH REPORT.

The following investigations were conducted by members of the staff:

1. The Seed Oils of *Bombax sessile* and *Lupinus termis*.

Bombax sessile is being cultivated in the Sudan as an experimental oil crop. Analysis of the oil showed that it resembled palm oil in composition. Since most of the Sudan's requirements of palm oil have to be imported, the cultivation of *B. sessile* should be encouraged.

The seed oil of *Lupinus termis* was found to resemble the oils of other members of the papilionaceae.

2. The Effects of Auxins on the Yield and composition of Cottonseed Oil.

The experiments on the effect of plant growth substances on cottonseed referred to in last year's report have been concluded. The auxins caused the plants to grow more rapidly, but toxic effects were also observed. Contrary to expectations, the oils were found to contain more linoleic acid and less oleic acid than oil from untreated cottonseed.

3. The Poisonous Principle of *Gloriosa virescens*.

In the 1952 53 Report, reference was made to a case of colchicine poisoning associated with the plant *Gloriosa virescens*. Further work this year has established that colchicine is the only poison present in this plant, and is present to the extent of 0.22 per cent on the dried roots. This is the first time that the poisonous principle of this plant has been identified.

4. Nimitti.

The work of collecting nimitti for the Medical Entomologist has been concluded. In association with this work, a series of determinations of the dissolved oxygen content of the Blue Nile have been made throughout the year.

5. Gum Arabic.

The British Pharmacopoeia and exporters specify that gum arabic must be free from "a gummy deposit upon solution" i.e. "stringiness." A further 241 samples of gum arabic were received from the Silviculturist in continuation of previous work on the subject. The observations confirmed previous findings that (i) "stringiness" in the gum from a particular tree tended to decrease during the picking season; and (ii) the smaller the yield, the greater the "stringiness."

6. Composition of Sudan Foods.

Analyses of experimental crops of sugar cane, rice, maize, cassava and dura were made.

7. Composition of Bat Guano.

During the past two years, a total of 23 bat guanos have been analysed, in order to find their value as fertilisers.

8. Economic Development of Zandeland.

Mr. Grindley made a short visit to the Yambio Experimental Farm, at the invitation of Dr. Willimott. There, Mr. Grindley inspected many experimental crops, and visited the cotton mills and soap factory at Nzara.

The following are among Mr. Grindley's recommendations:

- (i) Encouragement of bamboo cultivation;
- (ii) Establishment of a papain industry;
- (iii) Encouragement of Camphor production from *Ocimum kilimandscharicum*;
- (iv) Utilisation of mangoes.

9. Food Adulteration Khartoum.

Towards the end of this year, a preliminary survey of the foods on sale in Khartoum was started in order to detect any adulteration. The results of this survey are described in the Analytical Report.

It is hoped that in the coming year a similar survey will be started for drugs.

APPENDIX "O"

LIST OF PUBLICATIONS DURING THE YEAR BY MEMBERS OF THE STAFF

Name and initials of Author	Date of Publication	Title of Article	Title of Journal in which published	Volume number of Journal	Page number of Journal
D. N. Grindley	31.7.54	"Report of The Govt. Analyst for the period: 1.7.53 — 30.6.54"	—	—	—
D. N. Grindley and A. A. Akour ...	In the Press	"The Seed Oils of <i>Bomax sessile</i> and <i>Lupinus Termis</i> "	Jurnal of Science Food and Agriculture	—	—
D. N. Grindley and E. H. W. J. Burden	—do—	"Observation on the Effects of Auxins on the Yield and composition of Cotton-seed Oil"	Journal of Science Food and Agriculture	—	—
E. H. W. J. Burden, D. N. Grindley and G. A. Prowse	—do—	"The Poisonous Principle and Histology of <i>Gloriosa virescens</i> . Lindl."	Journal of Pharmacy and Pharmacology.	—	—
D. N. Grindley	December 54	"Place of Chemistry in the Sudan"	Proc. Phil. Soc. of the Sudan.	—	—
D. N. Grindley	April 1955	"A Trip to Zandeland"	—	—	—
E. H. W. J. Burden	May 1955	"Memorandum on the qualifications of the classified staff of Wellcome Chemical Labs."	—	—	—

THE SECTION OF MEDICAL ENTOMOLOGY.

BY DR. D. J. LEWIS.

Seventy-four collections were received for identification; 2110 specimens were identified and eight of the collections contained many thousands of specimens, ceratopogonids, chironomids, sarcophagids and mites. The reference collection now comprises numerous specimens belonging to all the main groups of insects of public health interest in the Sudan.

Specimens supplied, for teaching or research, to the East African Malaria Unit, the Graphic Museum, Khartoum, the Kitchener School of Medicine, St. Mary's Hospital, London, the School of Hygiene, Khartoum, and the South African Institute of Medical Research.

SANDFLIES.

Identification of sandflies from the Sennar area was continued until November, the total seen since October 1953 being 1415. These included 2 *Phlebotomus papatasi*, 119 *P. lesleyae*, 8 *P. adleri*, 7 *P. christophersi*, 481 *P. clydei* and 692 *P. antennatus*. There were, however, no *P. orientalis*, the species which is believed to transmit Kala azar in Kassala Province. Discussions were held with the Province Medical Officer of Health, Blue Nile Province, regarding the control of Kala azar, and it was recommended that at infected villages the application of residual insecticide against mosquitoes should be supplemented in the dry season. D.D.T. should be sprayed in soil cracks and any other likely resting places in an area including a 100—metre-wide strip outside the periphery of the village. According to present knowledge the spraying should be done in November or December with the object of killing sandflies till about July when rain reduces their numbers.

MOSQUITOES.

All the genera of mosquitoes in the Sudan have been revised and maps prepared showing the known distribution of each species. The number of kinds of Culicidae known to be present is as follows :—

	Species	Subspecies	Varieties
<i>Anopheles</i>	28	0	3
<i>Aedes</i>	33	0	1
<i>Culex</i>	44	2	1
11 other genera	50	0	2
TOTAL	155	2	7

The non-biting *Chaoborus anomalus* Edwards has been found to constitute a small part of the swarms of small Diptera which invade the river front at Khartoum each year. The larvae of this species are partly planktonic and are believed to float down the Blue Nile from the Sennar reservoir.

MOSQUITOES FROM AIRCRAFT.

Whitfield (1939, Bill ent. Res., 30, 365—442) investigated the transport of mosquitoes and other insects by aircraft in the Sudan and pointed out that there was little to be gained by further study because the risk of the spread of dangerous species had been demonstrated. Fifty-three mosquitoes found in aircraft since 1938 have, however, been received for identification, and are recorded in the accompanying table. One of them, *Taeniorhynchus fuscopennatus* Theo., is common in Uganda but not found in the Sudan. As in Whitfield's collections a considerable number of mosquitoes came from Eritrea, and species of *Culex* were common. Other insects from aeroplanes reaching Khartoum from the south included *Chaoborus ceratopogones* Theo., from Port Bell, *Tabanus taeniola* P. de B., *Ancala latipes* (Macq.) and *Stomoxys calcitrans* L.

Table showing mosquitoes collected in aeroplanes between September 1938 and September 1954 inclusive. The places from which the aeroplanes came are indicated by points of the compass. The mosquitoes were females except where otherwise mentioned :—

Place	Species	Direction from which aircraft came	Findings	Specimens
Geneina	<i>Anopheles gambiae</i> Giles	W.	1	1
"	" <i>squamosus</i> Theobald	W.	1	1
Khartoum	" <i>gambiae</i>	W.	1	1
"	" <i>pharoensis</i> Theo.	N.	1	1
"	" sp.	E.	1	1
"	<i>Theobaldia longiareolata</i> Macq.	E.	1	1
"	<i>Taeniorhynchus fuscopennatus</i> Theo.	S.	1	1
"	" <i>uniformis</i> Theo.	S.	4	5 (1)
"	<i>Aedes</i> sp., probably <i>caspius</i> Pallas	N.	1	1
"	<i>Culex univittatus</i> Theo.	S.	1	1
"	" <i>pipiens</i> L. or ssp.	S.	1	2
"	" " <i>fatigans</i> W.	E.	1	1
"	" " <i>fatigans</i>	S.	2	2 (2)
"	" sp.	N.	3	7
"	" "	S.	5	5 (3)
"	" "	E.	4	6 (1)
Port Sudan	<i>Theobaldia longiareolata</i>	S-E.	1	1
" "	<i>Culex univittatus</i>	S-E.	1	1 (3)
" "	" <i>sinaiticus</i> Kirkpatrick	S-E.	1	1
" "	" <i>pipiens</i> or ssp. <i>fatigans</i>	S-E.	2	2
" "	" <i>fatigans</i>	S-E.	2	8 (4)
Juba	" sp.	S-E.	1	3

(1) 2 males in 2 separate collections.

(2) 2 males.

(3) 1 male.

(4) 4 males in 2 separate collections.

ANOPHELINE MOSQUITOES.

A discussion on malaria control was held with Dr. L. Mara of the World Health Organization who visited the Section.

Publications of the W.H.O. have recently stressed the danger that resistance to insecticides may arise if larvicides are used which are related to residual insecticides used at the same time. In the Sudan oil alone will accordingly be used in the limited areas where larvicides continue to be used.

Seventy-five *Tilapia melanopleura* were released in the Gezira main canal above kilometre 77 to give the species a final opportunity of establishing itself in the irrigated area. These fish were reported to be effective in controlling water weeds at Wad en Nail.

Supplies of *Gambusia* were sent to Malakal and Port Sudan.

A water-dispersible powder containing 50 per cent gamma isomer B.H.C. was sprayed on panels which had been coated with mud to simulate walls of houses. The insecticide appeared to be at least as effective as 6.5 per cent gamma B.H.C. applied to give the same amount of gamma isomer.

Samples of old stocks of various insecticides from the Medical Stores were tested, and recommendations were made as to their use against Anophelines.

The Mosquito Control Officer visited the Section to study entomological aspects of malaria control in relation to proposed developments.

The Public Health Officer, Sennar, sent for identification many anophelines collected in villages near the reservoir in January. *Anopheles rufipes* appeared to be much less prevalent, relative to *A. gambiae*, than a year before, and it is thought that *A. rufipes* had probably only increased temporarily as a result of the raising of the reservoir level.

A survey of Anopheline mosquitoes was made between the Monasir area (above Merowe) and Wadi Halfa in March and April, in connection with the recent spraying campaigns of the Sudan and Egyptian Ministries of Health. In general few anophelines, all *A. gambiae*, were found, in contrast to experience in a previous survey in 1947. The scarcity was attributed to the spraying and to the effect of the Jebel Auliya dam. The release of water from the dam in February causes the river to rise slightly in the Northern Province and to fill many residual pools, usually until late in April when the hot weather may be expected to minimize malaria transmission. The most northerly place where Anophelines were at all common was Ardwan.

Culex theileri, a species common in Europe, was found at Shirri Island in the Monasir area.

No *A. gambiae* were reported from Egypt or from the Wadi Halfa district north of Ferka.

CULICINE MOSQUITOES.

Monthly summaries of the indices of *Aedes aegypti* were prepared as usual.

An inquiry was received about the control of *A. aegypti* on the northern part of the Red Sea Coast where drinking water is precious. Bruce—Chwatt (Colon. med. Res. Comm. eight ann. Rep.) has reported the successful use of B.H.C. cement pellets in domestic water jars in West Africa, and some were tested at Wad Medani. They consisted of one part of B.H.C. 6.5 per cent wettable powder, 4 parts of cement

and 24 parts of fire sand. It is hoped that under field conditions they will have a residual effect and be useful against *A. aegypti* in many parts of the Sudan, particularly in areas and at periods in which no residual spraying is necessary against anophelines.

CHIRONOMIDAE.

A large quantity of larvicide was used at Khartoum to find out if destruction of larvae is likely to be practicable. Nearly five tons of Gammexane D919, a crude and therefore relatively inexpensive form of B.H.C. containing 13 per cent of gamma isomer, were discharged to give a deposit of two grammes of gamma isomer per square metre on the bottom of the Blue Nile. The treated area extended from the Palace to a point 700 metres upstream and tow-nets were moored above and below the treated area to catch floating pupae. Numerous specimens were collected in January and February and examined together with samples of larvae which Dr. J. Rzoska kindly collected with a grab which covered some 400 sq. cm. of mud per sample. Many larvae had apparently been killed but no substantial reduction in the number of *Tanytarsus* pupae was observed, possibly because the particles of insecticide were rather large and also dissolved very slowly. It appears that a suitable larvicide should sink quickly, disperse well on the mud, and remain active for about three months. Two additional formulations, B.H.C. with kieselguhr and D.D.T. with bentonite, were submitted by the Imperial Chemical Industries Ltd. and the Giegy Company Ltd. Both insecticides were effective against young *Tanytarsus* larvae under laboratory conditions, but they are likely to cost more than the crude insecticides.

Many chironomid larvae and pupae drift down the river at night so that a very large area of the river bottom would have to be treated. In fact, radical control would involve an alternation of the fauna of this large river. It is believed that such control is possible but that the expense may be prohibitive because it would probably be necessary to spend many thousands of pounds on insecticides to give protection for a few months each year. Furthermore additional research on the chironomids and the general hydrobiology of the river is necessary, and, even so, success can not be guaranteed.

No reports were received of fish being killed in spite of the large quantity of B.H.C. used.

Further tests of insecticidal fog were made with the Swingfog and Tifa machines, with the cooperation of Mr. A. M. Toms, Spraying Officer of the Sudan Gezira Board, and the Sudan Mercantile Company (Sudan) Ltd. respectively. A (W/V) solution of 0.25 per cent pyrethrins (in Pysect) in Diesel oil was used, and some success was achieved in certain places. In future fogging might have a palliative effect in limited areas and might be improved by employing synergists and finding the optimum particle size for use against these minute insects. Furthermore a coarse fog might be effective in depositing residual insecticide in trees, which would otherwise involve the use of aircraft or other expensive means.

In view of the possibility that anti-larval measures will be impracticable it is necessary to make use of some of the various palliative measures which minimize the nuisance caused by the adult chironomids. Three of these methods are to use office or houses (1) separated from the Blue Nile by a thick belt of trees, (2) on a part of the river-front bare of vegetation, or (3) near the river, with vegetation, but protected each night by fogging.

SIMULIIDAE.

Twenty-one species and two "form" are now known to occur in the Sudan.

A record has been compiled of available information about "good" and "bad" years for *Simulium griseicolle* and chironomids at Khartoum, Wadi Halfa and other places. It is recommended that this should be continued in order to ascertain the fundamental causes of outbreaks, with special reference to the construction of new dams.

MUSCIDAE.

The problem of resistance to insecticides has recently prompted some American workers to investigate the value of sodium arsenite and other poison baits against house-flies. At Wad Medani one per cent sodium arsenite and 33 per cent molasses in water was used experimentally and proved very effective in the dry climate which increases the attraction of the bait. This method of control, however, can only have a limited application in the Sudan owing to the necessity for strict precautions to prevent risk of poisoning to human beings.

An account of the London experiments on resistance to insecticides in flies from Omdurman and elsewhere has been published by Busvine (1954, *Nature*, 174, pp. 783—785).

Preliminary tests were made with Diazinon against *Musca* at Omdurman in cooperation with the Senior Public Health Inspector. Pit latrines were treated with one per cent dust and 20 per cent wettable powder at the rate of 0.5 gramme of the active principle per square metre of the bottom of the pits. Larvae and adult flies were killed and the results encouraged more extensive work with wettable powder, because it is available at a strength of 20 per cent or more of Diazinon whereas only weak concentration can be obtained in dust form. It is by no means certain, however, that flies will not become resistant to Diazinon and it is necessary to improve basic sanitation.

MITES AND TICKS.

Many specimens of the tropical fowl mites *Ornithonyssus bursa* Berlese were received from the Gezira and the Fung. This species attacks people in many villages in the Sudan but was seldom reported until recent years.

A monograph on the ticks of the Sudan is being prepared by Mr. H. Hoogstraal who has published a preliminary note (1954, *J. Parasitol.*, 40, pp. 304—310).

SCORPIONS.

The first part of Dr. M. Vachon's study of the Sudan scorpions is in preparation.

PUBLICATIONS.

Papers on mosquitoes of the Blue Nile area and the Sudan in general, and on Chironomidae, Diptera and medical entomology in the Sudan are in preparation.

The following have been published recently or are in the press :

KIRK R. and LEWIS, D. J. (1955). Studies in lishmaniasis in the Sudan. XI. *Phlebotomus* in relation to lishmaniasis in the Sudan. In the press.

- LEWIS, D. J. (1954). Muscidae of medical interest in the Anglo-Egyptian Sudan. *Bull. ent. Res.* 45, pp. 783-796.
- LEWIS, D. J. (1955). Calliphoridae of medical interest in the Anglo-Egyptian Sudan. In the press (*Bull. Soc. Fouad 1 er Ent.*).
- LEWIS, D. J. (1955). Nimitti and some other small annoying flies in the Sudan. In the press (*Sudan Notes*).
- LEWIS, D. J. (1955). The Culex mosquitoes of the Sudan. In press (*Trans R. ent. Soc. Lond.*).
- LEWIS, D. J. (1955). The Aedes mosquitoes of the Sudan. In press (*Ann. trop. med. Parasit.*).
- LEWIS, D. J. (1955). The Anopheline mosquitoes of the Sudan. In the press (*Bull. ent. Res.*).
- LEWIS, D. J. (1955). The Culicidae of the Sudan. In the press (*Parasitol.*).
- LEWIS, D. J. (1955). Notes on Simuliidae in the Sudan. In the press (*Bull. Soc. Fouad 1 er Ent.*).
- LEWIS, D. J. HENRY, A. J., and GRINDLEY, D. N. (1954). Daily changes in the number of chironomid midges at Khartoum. *Proc. R. ent. Soc. Lond. (A)*, 29, pp. 124-128.

THE MURLE.

REPORT OF A PRELIMINARY ENQUIRY INTO REPRODUCTION RATE BY PROF. DEAN A. SMITH, PHYSIOLOGY DEPARTMENT, UNIVERSITY COLLEGE, KHARTOUM.

INTRODUCTION.

Report suggesting the existence of serious sub-fertility in the Murle tribe having recently been received, this enquiry was undertaken at the invitation of the Governor, Upper Nile Province and of the Director of Medical Services, Ministry of Health, in April, 1955.

At this time of the year, the majority of the Murle are widely scattered, living in small groups with their cattle in toiches over a large area. No attempt could therefore be made at any form of survey nor even an examination of representative sample groups. The object of this short, the existence of a problem, simply to establish, if possible, the existence of a problem, to gain some idea of its magnitude and nature and on this basis to formulate a plan for further investigation at a more suitable season.

In the event my short visit proved more fruitful than could possibly have been expected, owing to the very full co-operation of everyone concerned, especially the Murle themselves. But it cannot be too strongly emphasised that the *object of this report is to draw attention to the existence of a problem*, not to define it in precise terms nor to offer anything approaching a full solution to it. This report does not embody the results of any full scientific investigation or survey, nor are its very tentative conclusions supported as yet by any statistical data.

Nevertheless, sufficient information was gathered to justify, in my opinion, not only progress to the next step, namely as full-scale an investigation as possible, but also the inauguration at the same time, of measures to control what can, I believe, be confidently stated to be at least a major factor in the causation of the unsatisfactory reproduction rate of the Murle, namely gonorrhoea.

Without doubt other factors are involved, social, medical, moral, psychological genetic, or concerned with the possible recent tendency for ancient tribal institution to disintegrate. All these demand full investigation. But in my view, an attempt to deal with an obvious major factor, mentioned above, need not await an assessment of the other possible contributory factors : indeed such assessment may well be impossible until at least some of the burden of this disease has been lifted.

THE MURLE.

The main, almost the only, source of information on the social structure, customs and tribal organization of the Murle is the report written by B. A. Lewis in about 1950. Almost all the possibly relevant information briefly summarized in this section is derived from Lewis and is quoted with full acknowledgement of its source. In some few directions it has been amplified by study of miscellaneous notes by past District Commissioners in the files at Pibor, by conversation with officials in the Province and the District and by personal enquiries among the Murle. Even in the latter case, most questions were prompted by knowledge of Lewis's work and were in many instances aimed at discovering how far, if at all, the situation has changed since his work in the area.

The Murle are a Nile-Hamitic tribe, thought to be about 40,000 strong at present, who inhabit an area centred approximately at Pibor in 6°50' N. : 33°10' E. During the rains (August to October approx ;) they congregate in permanent villages along the rivers Pibor, Lotilla, Veven and Kanger, mostly within about 30 miles of Pibor Post. As the river falls, the majority of the tribe especially the young men, leave the rivers with the cattle and wander very widely through the vast grassy plains especially to the East and North-West in pursuit of good grazing. The plains Murle cultivate relatively little dura : small patches are shown in the wet season round Pibor, but it is that those sections of the tribe dwelling at the heads of the Lotilla and Veveno do not cultivate at all. The Murle of the plains are said to be among the richest in cattle of all the tribes of the Southern Sudan and the cattle population outnumbers the human by not less than four to one. Their diet is very largely derived from animal sources : the Murle milk and bleed their cattle and kill them for meat. They also own significant numbers of sheep and goats. They are exceedingly skilled hunters in a country full of all kinds of game and at suitable seasons they fish the rivers with ruthless efficiency and achieve very large catches. Apart from the small amounts of dura grown, food of vegetable origin is scarce and seasonal. At times wild fruits are fairly extensively eaten.

Other selected information concerning the Murle social structure may be very briefly mentioned as having possible relevance to the present enquiry.

The Murle are polygamous, patrilineal and patrilineal. Inheritance in the male line is of great religious as well as social importance. On the other hand all children of a lawful wife, however acquired (*e.g.* by a previous marriage or illicit union, by adoption, purchase, kidnapping or as the spoils of war), are the lawful children and heirs of the husband. While a complex web of clan and family kinship divides the tribe, as it were, "vertically," a very powerful and highly developed age-set system divides the male population "horizontally." The Warrior age-sets, from about 18-30 years of age, used in former days to be often at war, making raids on neighbouring tribes, or defending their cattle and families against raids by neighbours. In addition to herding and looking after the cattle in the toiches, they had to defend them and always tried to increase them by plunder. This, together with hunting and participation in larger wars either of aggression or defence, kept them fully occupied throughout the dry season and gave them many opportunities to distinguish themselves. Then, and now, the Murle men do not marry until after their time as warriors *i.e.*, at about 28-30 years of age, and often not till considerably later, as it takes a long time to accumulate the high bride-prices (up to 30 cows). The main reason for existence of the warriors as such has now disappeared : only a small proportion are really needed for the cattle-herding work and the great majority have little to do and no means of gaining distinction except by occasional hunting feats. Very much time is spent "flirting" with young girls and having "affairs" with the younger married women. The pre-marital "flirting" exercises are elaborate and involve prolonged physical contact, but usually stop short of full sexual intercourse. It is a very great shame for an unmarried girl to become pregnant. On the other hand it is possible that repressive conditioning of the male during these prolonged, unconsummated flirtations may affect his subsequent fertility.

With the younger married women, however, no such restraint exists and "affairs" between them and the "bachelors of the night" are now, it is believed, so common as to constitute a widespread state of promiscuity. This was not always so : in former days before the advent of any outside administration, adultery was a wrong punishable by death at the hands of the injured husband, though it is probable that this extreme sanction was seldom applied. In 1918 it was recorded that the Murle regarded adultery as a joke at the expense

of the cuckolded husband. Now it seems to be accepted without comment without even laughter. The reasons given for this change, which has taken place within the memory of men still living are (i) that the Law has removed the only deterrent penalty (death) without replacing it by any other (*e.g.*, a fine of cows) and (ii) that so few children are now born, that a husband will readily condone unfaithfulness in a wife in the hope that she may become pregnant—"find a child in the bush"—the child, of course, becoming the legal heir of the husband, no matter who is its biological father.

The Murle have always been, and to an extraordinary extent still are, very isolated. There is nothing in tribal memory to suggest slave-raids from the Northern Sudan nor even the visits of Arabs or Europeans until almost the present century. The great change in the life of the tribe came in 1912 when, as a result of their persistent onslaughts on the Bor Dinks, an expedition the second Beir Patrol was sent against them and after inflicting a crushing defeat, left a military administration. (The first Bier Patrol visited the area in 1908 but was withdrawn). The Military administration was very light, as the Murle formed only a small and inaccessible part of a large district which contained other turbulent elements. The Civil Administration took over in 1936, but at first it was mainly preoccupied with the Anuek, the N.E. neighbours of the Murle, and the urle themselves have really only felt the continued and progressing effects of administration, law and order for little more than fifteen years.

THE HILL MURLE OF THE BOMA PLATEAU.

It was not possible to visit this branch of the tribe on this occasion, so little can be said about them, though full investigation may be of the first importance later. The Boma Murle live in the foot hills of the main Abyssinian mountain range in country infested with tsetse fly. They own no cattle and live by cultivation of grain and husbandry of sheep and goats.

They are non-nomadic, settle cultivators and grow coffee in addition to their staples. It is said that they are almost free of venereal disease, though yaws is common, and that any population or fertility problem is very much less pressing than in the case of the plains Murle. Indeed I was told by one Boma Murle that his clan have no such problem at all. If this is true or even nearly true, simultaneous survey of the two ethnologically similar but environmentally different groups might possibly provide the clues necessary to solve the problems of the Murle of the Plains.

EVIDENCE OF A POPULATION OR FERTILITY PROBLEM.

It must be stated clearly at this point that there is, at present, no absolute, irrefutable, statistical evidence that the Murle have a population or fertility problem at all; such absolute evidence can only be based on a census and there has never been a census. Indirect evidence had therefore, to be sought, and this is so abundant as fully to justify, in my opinion, a full investigation. This evidence is summarized below.

A census is planned for September 1955. This will provide much valuable information, but will have its limitations. The main limitations are (1) that being the first census to be carried out in the area, no comparison with a past state of affairs is possible: no indications of changes or trends will necessarily emerge, and (2) that being part of a nation-wide census it will not be possible to ask all the questions necessary for the particular purpose of this inquiry. A future investigation team will certainly have to do some additional sample census work of this special nature.

Attention was first drawn to the apparently unsatisfactory nett reproduction rate of the Murle in 1949 by Lewis, who noted the very high incidence of venereal disease as among the probable causes and gave an able analysis of the social conditions which would tend to facilitate its spread and ensure its perpetuation. Lewis also gave figures for the age-group distribution in the population of five villages that he had investigated in detail. When compared with similar figures for neighbouring areas, these figures confirm rather strikingly that the apparent scarcity of children among the Murle is real. These are shown in the following table (the comparative figures have been provided by the Anthropology Laboratory, Oxford in a personal communication).

	Number of adults	Number of Children	Number of Children as a percentage of number of Adults	Number of Children as a percentage of the total population
Murle (5 villages)	353	195	55%	36%
Dinks (1 village)	181	168	93%	48%
Wadigo (District)	12,534	13,453	107%	52%

As additional evidence of the real lack of children in the Murle is the fact that over the last few decades they have made increasingly frequent, often successful attempts to adopt, buy, barter, kidnap or seize children from neighbouring tribes, to the serious prejudice of peace and security.

Over the past two years Dr. A. G. Roade, of the American Mission, Pibor, has questioned every woman coming for treatment as to how many children she has born. "Almost all of them have had only one" and then no more.

Finally on this point there is the view of the Murle themselves. The considerable number to whom I talked were quite unanimous in the opinion that it is now very difficult for Murle women to have children. One opinion is entirely representative of very many. "In the old days Murle women went on having children all the time they were able; most women had eight, ten even eleven or twelve babies. Barren women were rare. Now most women have one child, some two, a few three, and then no more. Many women never have a child at all. I only know of one woman (of child bearing age) who has four children" All said the same.

Possible causes (a) of a low reproduction rate.

If for the moment, and pending further evidence it can be assumed that there is a true population decline, a low nett reproduction rate, in the Murle, the possible causes must next be considered. These fall into three groups, any or all of which might be of major importance :

- (1) True infertility or sub-fertility, that is, a low conception rate.
- (2) High abortion or still-birth rate.
- (3) High Infant Mortality Rate.

As regards (2) abortions and still-births, we have no information. Certainly they do not happen with sufficient frequency to worry the people themselves. All the Murle whom I asked about the point admitted that these things did happen now and again, but not more often than they seemed to expect. The census, if the appropriate questions are asked, may throw some light on this.

All District Commissioners, Mission Doctors and the people, are agreed that the Infant Mortality Rate (3) is substantial. All are equally unanimous as to its main causes. But all agree that it is *not* the main factor in the shortage of children. Several groups of Murle to whom I put the question agreed that of infants born alive some do die in the first year of life, the usual causes being *abur dole* (fever), *amor keng* (belly complaints) and *tadowaen* (chest trouble). Dr. Roade confirms this. He writes.....“those who have had two or even three children have lost some of these due to malaria, dysentery or pneumonia.”

Survey can add a lot to our scanty knowledge on this point especially as regards malaria. On the present evidence, it seems reasonable to suppose that the Murle I.M.R. is at least no higher than that of their neighbours, and is probably much the same as that found generally in tropical Africa. A figure of the order of 100-300 per 1000 might be expected. But while rates of this order are general and much higher rates are known in other parts of Africa, this may be an I.M.R. too high for the Murle to afford if, in fact, their birth rate is low. Measures aimed at lowering the I.M.R. may prove necessary at a later date.

Possible Causes. (b) of Infertility.

Among these must be considered the following groups :—

- (1) Medical Causes ; that is, specific organic disease tending to impair fertility in the male, female or both.
- (2) Nutritional causes ; general or specific.
- (3) Social causes ; for instance a very late marriage age ; voluntary contraceptive practices and c :—
- (4) Genetic causes, which might conceivably result from prolonged in-breeding
- (5) Psychological causes, what might roughly be described as “failure of the tribal will to live.” This might arise, for instance, from general demoralization following a crushing defeat, from the disintegration of tribal institutions and customs, from a failure to adopt to changing conditions, increased sophistication and new values, and from many other psychological states arising from changed social conditions.
- (6) Physiological causes ; it has, for instance, been suggested that prolonged and persistent over-indulgence in sexual activity may decrease fertility. There is little or no evidence known to the writer, that this in fact happens in normal people.

It is not suggested that this list covers every possibility, nor that the groups of possible causes are in order of importance.

As at the time of my visit it was not possible to do any direct investigation or survey, indirect evidence had to be sought from the few observers (officials, medicals) working on the spot and from enquiries among the Murle themselves. It seemed that a possibly fruitful line of enquiry might be to try to find out when and how the present state of affairs arose : some clues might thus be gained as to its causes.

On those lines I questioned a considerable number of Murle, particularly but not exclusively older men, in small groups, with the invaluable help of the Sub-Memur, himself a Murle. The evidence thus acquired less is, I fully realize, hearsay and therefore biased : it may be further biased by the predominance of the elderly among those questioned, for the Murle share with almost all other peoples a firm conviction among those past middle age that " things aren't what they were in my young days. " However, the answers were so consistent and were expressed in vivid terms indicative of such intelligent observation that I think they must be treated with much respect. Moreover the conclusions reached were entirely consistent with what was seen in the dispensary and reported by the Mission Doctor.

All the elderly men are unanimously convinced that in the time of their grandfathers, their fathers, and even in their own youth, the Murle had as many children as anyone else. Women went on having children up to the menopause and a man with three or four wives might easily have twenty or thirty children. Indeed I was privileged to meet one octogenarian (possibly a nonagenarian) who had nine surviving children, now middle-aged, by his second wife ; his first wife and her eight children having been lost to the Anuak in a raid about forty years ago.

All the Murle men are equally convinced that the cause of this trouble is *Karongmal*, gonorrhoea. (The graphic descriptions leave no doubt as to the of this translation of the Murle word).

" Was this disease common in your father's time ? "

" When we were young it did not exist ; we never heard of it "

" When did it come ? "

" When we were young warriors, it came. It came when the soldiers came and stayed. It started in the North of our land and soon spread through the whole country. Soon after that our women started having fewer babies. "

" The men had the disease too ? "

" Of course ; that was how the disease spread. But our men are still potent and produce seed ; but it is killed in the women. "

" Why is it killed in the women, do you think ? "

" We think it is the *Karongmal*. "

" Do you think it makes men sterile too ? "

" They still produce their seed, but it may. In the old days it sometimes happened that a woman did not bear a child to her first husband but she always easily got a child by another man. That very seldom happens now. If a woman does not have a child by one man, she will not have one by others. "

" I see that many men have swollen testicles (hydrocele). Was that always common ? "

" In my father's time it was never seen. Now it covers the whole country. And we older men can never pass our urine freely " (strictures due to old gonorrhoea are very common).

This verbatim account of how one conversation emerged from translation is entirely typical. All those questioned said, in substance but often in quite different words, the same thing. (As regards hydrocele, the Murle customs of sitting, walk-

ing and specially dancing with the genitalia firmly trucked between their legs may well be a contributory factor).

There seems in this mass of testimony strong presumptive evidence that both infertility and gonorrhoea have appeared quite recently and more or less simulataneously, and that the latter was introduced at about the time of the second Beir Patrol in 1912. It does not seem unduly risky to postulate a causal relationship between the two, without, of course, excluding may other possible causes for the relative sterility.

This view coincides with that of Dr. Roode, who has worked among the Murle for two years and of Dr. Mary Smith who has recently gone to Pibor. Dr. Roode writes, in a report to the D.M.S. :—

“ The Murle young girl is, relatively speaking, rather chaste and moral as an unmarried woman. It is considered improper for her to become pregnant before marriage. However as soon as the girl becomes married then all restrictions on remaining moral and true to one husband are dropped. Then she accepts all men or any man that can cultivate her favour. You might say she becomes promiscuous. Almost invariably during her first months of marriage she acquires gonorrhea. Repeated attacks of gonorrhea then cause stricture and closure of the fallopian tubes. It is usually very likely that she is already pregnant and thereafter may have no more children. I have made it a practice to ask every woman coming for treatment how many children she has borne and almost all of them have had only one, and those who have had two or even three children have lost some of those due to malaria, dysentery or pneumonia. Another finding in the Clinic is that almost all Murle women complain of low back pain — to me an indication of pelvic inflammation.

Again I say — this is only one aspect to be investigated. There may be other factors involved.

It also coincides with my own limited observation. I spent some part of several days seeing patients in the Pibor Dispensary and was able to form some idea of the general disease pattern at least of the selected section of the population that seeks western treatment. My diary entry after my first visit begins “ Most cases are V.D.....,” and although I did not collect statistics, that remained my impression. The Medical Assistant had about twelve in-patients housed in tukuls at the time of my visit and of these only two were not V.D. cases. Gonorrhoea, in all its stages and all its varied manifestations predominates. A small proportion of cases now receive some treatment, which is barely adequate even for the simplest, recent acute infections. (The doubtful efficacy of the treatment is no reflection on the Medical Assistant, nor on the Province Medical Organisation. It is partly due to shortage of drugs, staff and amenities, but mostly to the fact that the Murle have yet to grasp the idea of “ coming back for another dose tomorrow ”).

The vast majority of cases have never had any treatment at all.

Although there are no numerical data, the general situation with regard to gonorrhoea seems fairly clear. It is extremely widespread, possibly almost universal in the adult age-groups, and social conditions exist which are ideal for its spread and inevitable self-perpetuation. The situation with regard to syphilis, yaws and other venereal or related diseases is by no means clear.

The Murle recognise and have names for four diseases which they regard as venereal and in some way connected with the acho ther, but not in all cases with their lack of children. These are :—

Karongmal,
Bongka,
Kede,
Kersmedek.

Karongmal, as has been said, seems without doubt to mean gonorrhoea. *Kede* is predominantly an affection of the skin, often involving the extremities, though the Murle, very astutely in my opinion, seem to recognise goundou and juxta-articular nodes as part of the same disease. All the cases that I saw that had been labelled *kede* were clinically yaws, though other skin diseases as for instance tinea versicolor, probably get included under the same diagnosis. I was told that *kede* is an old disease, "It was ancient in the time of our grandfathers and came from the hills," which tends to confirm its identification as yaws. The Murle do not regard *kede* as a serious disease: they recover from it and it has nothing to do with the children. *Keremedek* means "pains in the bones." I doubt if it represents any one disease entity. The term is probably used to cover the "aches and pains" associated with most fevers and that large group of painful conditions known to the Western lay public, with no more precision than that of the Murle, as "the rheumatics." But at the same time the Murle fit *keremedek* into this group of venereal and similar diseases, which suggests that the term also covers the bone-pains of yaws.

Bongka is a venereal disease of which the Murle state that they knew nothing until recently, more recently even than the coming of gonorrhoea. Three accounts of the appearance of *bongka* were given to me as follows:—

"It is a new disease: It came through the Anuak at the time of the fighting with the Taposá." (? 1935)

"A new thing. When the soldiers fought the Italians, it came to Lillot and took two or three years to spread through the country." (? 1940).

"It came when there was fighting with the Italians, at about the same time as our dogs first got rabies." (? 1940)

Up to now, as far as I know, the word *bongka* has always been translated as "Syphilis." This interpretation must be accepted with caution and needs detailed investigation. When I asked for a description of the manifestations of *bongka* I gathered from the replies that the name is given to any condition in which there are sores, spots or ulcers, whether single or multiple but most often multiple, anywhere around the genital region. This description fits several conditions other than syphilis; indeed it does not sound particularly like syphilis at all, except cases with condylomata. It would equally well, or better, fit "soft sore" (chancroid), ulcerating granuloma, scabies, furunculosis or even tinea cruris. Clearly more information is needed before we can begin to assess the status of syphilis in the area, or the meaning of the word *bongka*. Nor, in this connection, can we ignore the possible existence of a local form of non-venereal endemic syphilis.

In this aspect of the problem, I am most conscious of my limitations. Although I have some field experience of this type of investigation, I have no claim to specialist status as either an anthropologist or as a social psychologist. My speculations are therefore unformed by special training or knowledge and must be read with this reservation constantly in mind.

Although superficially many aspects of Murle life appear to be, and doubtless are, still governed by age-old custom and belief, continuing unchanged through the centuries, there can be no doubt that the intrusion of influences from beyond the orbit of neighbour tribes must produce, sooner or later, changes in attitude,

values, loyalties and ultimately in behaviour. This intrusion has only occurred well within the present century and effective administration and the establishment of Law and Order is not yet a generation old. Some of its social and psychological effects are already apparent to the untrained eye ; others could be detected beneath the surface, while others yet are still not perceptible.

Probably the first event to exert a profound effect in this present connection was the crushing defeat of the Murle by the Beir Patrol in 1912. This completely broke them as a fighting people and it was as fighting people, with the highest regard for personal courage and skill in war and, in their own tradition at least, a shining record of victory and success, that they had hitherto regarded themselves. Even their sacred Drums, though used on occasion as instruments of justice or for rain-making, were essentially engines of war.

Demoralisation, despondency and the sense of a meaningless future must have been profound and might well have been reflected in a low fertility, the sub-conscious attitude being, " What is the good of a broken race going on into the future ? Why bring children into a hopeless world ?"

With the advent of administration the need for Warriors disappeared. The Warrior age-sets once the most important people in the tribe, are now largely idle and have degenerated into mere herdsmen. They have no chance to win the praise of the elders nor the admiration of the girls, to complete their initiation by killing an enemy in battle, or to win by their own prowess positions of leadership or responsibility. Not only has much of their occupation disappeared but with them ambitions that made them readily submit to a semi-military discipline during the ten or more years of their warriorhood. This idleness and rapid decline in status among the warrior grades must— it seems to me, lead to disintegration of moral codes and tribal tradition, and produce a frustrated and disaffected group for whose energies sexual promiscuity provides an obvious outlet. Moreover the disaffection of the young men is often aggravated by the taunts of their elders, many of whom are old enough to have blooded their spears in war.

In many other ways the old tribal institutions must suffer gradual decay. Mention has already been made of the removal by the Penal Code of the only deterrent to adultery. Even the Chiefs and the Drum-Chiefs themselves must be affected : the coming of a higher legal authority, a supreme court of appeal, however skilfully it is grafted on to the old tribal system, must in the end weaken the influence of the Chiefs, who were once the supreme arbiters. In former days they were remunerated for their services (though that was not how they or the people regarded it) by receiving the largest share of the spoils of war. Now they must be paid, and the character of their authority must inevitably change. The gradual transformation of a hereditary ruler, with supernatural powers, into a salaried Civil Servant must affect the attitude of the people to him, and his own attitude to his responsibilities.

Is it possible at this stage, on the basis of the very scanty evidence, to reach any conclusions, however tentative, as to the existence or significance of any other possible causes, main or contributory, of Murle Infertility — other, that is, than their overwhelming load of gonorrhoea and possibly other related diseases ?

Superficial enquiry produced no evidence seriously suggestive of a *Nutritional* factor. Various informants were in general agreement that, at least since the devastating cattle epizootics of the 1890's, the Murle, as a community are rarely if ever short of food. Nor did I see, either in Dispensary patients or in the population at large, any obvious stigmata of malnutrition. The average Murle is lean : fat individuals are quite uncommon. It is likely that future survey may

show that the mean weight/height ratio is low by Western standards, but not as low as that of neighbouring Niloties. In the absence of genetically and environmentally similar control groups for comparison, it would not be justified to interpret this low weight/height ratio as evidence of mal— or inder-nutrition, though it has often done in the past.

It is true that the diet of the Murle of the Plains is unbalanced, by any standard, particularly through the dry season. A very high proportion of the food intake is of animal origin, meat of cattle and game, fish, milk and blood, and there must be a relative preponderance of protein and a relative shortage of carbohydrate. A similar type of diet is concumed by the Masai, whose fertility is also reputedly low. This *may* be significant but it is not necessarily so. A casual relationship between a high protein intake and infertility has been postulated, but the evidence is unsatisfactory and the idea has received little support. Even if its truth could be demonstrated, why have the Murle (and the Masai) become only recently infertile, when their dietary pattern has, as far as we know, remained substantially unchanged for generations? In this, as in other aspects of the problem, a comparison between the Plains Murle and the Hill Murle might to instructive.

While evidence of serious malnutrition is at present lacking there may nevertheless be a strong case for encouraging increased grain cultivation, with the object of 'settling' a larger number of the tribe.

Similarly I found nothing to suggest the adverse operation of any genetic factor, nor any social circumstance conducive to *voluntary* limitation of births. On the contrary all the Murle of whatever adult age-group seemed genuinely concerned at the low reproduction rate and anxious to bear or beget children. That this is the conscious attitude of most of the tribe is confirmed by such things as their condoning of adultery, their attempts to acquire foreign babies, and the care with which wives are chosen from families reputed to be, or to have been, exceptionally fertile. The Governor of Upper Nile Province recounts that in recent Province Council meetings, when the representatives of other tribes have asked for better roads, or more schools, dispensaries or hospitals, the one persistent demand of the Murle has been for more babies.

While conclusive proof must await the results of further survey and detailed investigation, this preliminary enquiry has yielded presumptive evidence of serious infertility among the Murle and that gonorrhoea is among its major, *immediate* causes. But behind this immediate cause, the disease that is, as it were, the main mechanism of the infertility, there must lie profound changes in the mass psychology of the people, related to recent changes in their social situation and to the impact of external forces, which are at the ultimate root of the trouble.

Comparatively little of this is at present aparent at least to the untrained observer, but the old order is changing. Initiation ceremonies have not been held in this century. The Murle are slowly losing some of their old values and must adapt to new ones consisent with their place in a world infinitely bigger than they knew existed. Failure to adapt could lead to infertility for "when the old disintegrates and we cannot accept the new, what is the use of going on?"

I feel strongly that influences such as those indicated and there must be very many more—are of importance in the present Murle problem. But just how great their importance is I am unable to assess. Nor do I know whether such changes are of significance in the causation of infertility *apart from* V.D., or whether the prevalence and spread of V.D. is simply a manifestation of them. It may not be possible to reach definite conclusions on the latter point until the immediate effects of the V.D. have been diminished and it is possible to see what lies behind them.

But in either case the fullest study of these factors and influences must be made as soon as possible, if only because it is necessary for the control of V.D. Gonorrhoea can now be treated with speed and efficiency, but such treatment would be wasted by early-reinfection unless the Murle can be induced to change their present sexual behaviour pattern. This requires the reinstatement of old values or their replacement by new ones that are acceptable. For this a skilled assessment of tribal attitude is vital, not only for the reason given, but because, if other deeper causes lie behind the obvious one, any change in social behaviour pattern in the right direction would mean that half the battle was won.

FUTURE WORK.

It will be clear from all that is written above that, as a result of my brief investigation, I was quite convinced that there is a real infertility problem amongst the Murle, a problem, moreover, of such magnitude and urgency as to merit, even to demand attack at the earliest possible time, on a wide front, and with all the energy and resources that are available or can be made available. This is my personal view—and I have no illusions of infallibility ; nor have I irrefutable proofs. It is therefore with considerable diffidence that I offer the following suggestions as to the forms that future work might usefully taken on the assumption that my view of the urgency of the situation meets with general agreement.

In formulating a plan of campaign, the following general headings may form a useful framework :—

A. *Further Investigation.*

1. Census,
2. Survey, (a) General Health.
 (b) Venereal Disease,
 (c) Infant Mortality,
 (d) Socio-anthropology.

B. *Treatment.*

1. Mass Treatment of V.D.
2. Follow-up of V.D. Treatment,
3. Treatment of other conditions.

C. *Timing.* Access, transport, personnel, etc.

D. *Social Measures.*

1. Specially related to V.D. Transmission,
2. General, the Tribal Integration, (including education, agriculture, etc.)

E. *Expert Professional Assistance and Material Help.*

It would obviously be premature to attempt any detail we do not know enough yet—and any scheme must retain sufficient flexibility to meet unexpected findings or a changed situation.

The census planned for September, 1955, should provide, on a sample basis, and if the census officer can be persuaded to adapt his questionnaire to the special needs of the area, the following information :—

1. The age-group distribution by sexes,
2. The marital distribution, e.g. number of wives per husband, etc.

3. The fertility pattern, e.g. number of children per married woman, age of youngest, etc.
4. Stillbirth and abortion rate,
5. Infant and child mortality rate.

It is unlikely however that the census will provide enough special data for the present purpose. A survey team will probably have to supplement it with detailed reproductive histories of sample or selected family groups.

The aims of a *Survey*, if undertaken, should be, I think, to secure as much information as possible from representative samples of different Murle groups, on the following main points :—

- (a) *General health status* : body measurements clinical examination, with special reference to—endemic disease, parasites, helminths, nutrition, this might involve blood examination for malaria, filaria etc., stool examination, etc.
- (b) *Venereal Disease* : the prevalence, distribution, type, stage of—gonorrhoea, syphilis, yaws, non-venereal endemic syphilis, chancroid, etc. their complications and sequelae, especially as regards male and female sterility and any physical or social conditions relevant to their transmission. This might necessitate dark-ground microscopy, Kann and or Wasserman testing, semen analysis.
- (c) Infant and child morbidity and mortality.
- (d) In addition information should be secured on such things of genetic significance as blood-group distribution and the incidence of sickling. Detailed family histories would be valuable ; and, both in the survey and otherwise every effort should be made to assess mental attitudes and social conditions.

The timing of any operation in the area is dictated by the possibility of movement and the migratory habits of the Murle. The latter are concentrated along the rivers, mostly within 30 miles or so of Pibor, during the months of August—October inclusive, when the great grassy plains (and the roads) are flooded. At this time, however, the rivers are at their highest and access is possible by steamer to Pibor and points North of it, e.g. Lukwangoli, while such other centres of population as Gumuruk and Fertait can be reached by launch or on foot. This is the only feasible time for a general survey, as when the roads are open the people are widely scattered and inaccessible. (The laboratory and general medical facilities of the “Lady Baker” would solve many practical problems she could be made available).

The situation in Boma is quite different and a comparative survey in that area would, I think, have to be done in January/March, with transport by road.

During my recent visit I was most impressed by the obvious anxiety of the Murle about their own infertility problem, and the willingness, even the desire of those that I met to co-operate in any way in its investigation and alleviation. As the Murle are in general quite unaccustomed to the methods of Western medicine, they might have been expected to prove rather difficult subjects for any survey, especially one involving very personal questions and embarrassing examinations. The prevailing spirit of willing cooperation is therefore a tremendous asset. How long it will prevail I do not know. The Murle seemed genuinely to welcome my visit, but in spite of my repeated explanations, I had the impression that they still entertained a hope of miraculously quick results. On these grounds I feel that

there is a strong case for going on to the next step, the general survey, in Aug.—Oct. 1955, *if possible*. This is very short notice and it may be impossible to organise a fully adequate survey in time. If this is so, it cannot be helped, but delay till the rains of 1956 does involve some risk that enthusiasm may, disappointingly, give place to indifference, even to resistance. This may be an exaggerated view, but I do feel that avoidable delay might prejudice the success of the entire project and create disaffection that might be very troublesome to the Administration and condemn the Murle to further disintegration.

For just the same reasons I feel that there is a strong case for combining the survey with the insuguration of a *mass treatment campaign*. Ideally it would clearly be preferable to wait for the full results of the survey before starting to treat. In the circumstances there is a considerable chance that the arrival of a team that just asked more questions and examined, without “doing anything about it,” might have as depressing and antagonising effect as not going at all.

Subject to expert opinion, I would venture the suggestion that the use of single-dose treatment by modern antibiotics, effective simultaneously against gonorrhoea and the treponemal diseases (syphilis, yaws) makes it not only possible but actually desirable to combine treatment with survey in a single mass campaign.

It is necessary, too, to consider the possibility of setting up and maintaining treatment posts or mobile treatment units to deal, after the initial operation, with residual, re-infected or relapsed cases, so that treatment should be available to at least a high proportion of the Murle for most of the year. It is premature to go into details as to the possible form this follow-up service might take.

It must be made clear that there are very many Murle men and women who, through long-standing or repeated disease, are now irrecoverably sterile. They cannot be made fertile again but they can be made non-infectious. The aim of treatment must be the complete cure of recent acute infections and re-infections especially in young people, and the rendering non-infective of *all* cases, including those of such long-standing that complete cure of the effects of past disease cannot be hoped for. Most important of all, *treatment of all the contacts* of any person found infected must be insisted upon, and strenuous efforts will be needed to trace such contacts. In a word, to cure all who are curable before the disease sterilises them: to alleviate and make non-infective those too advanced for radical cure, so that they cannot infect others.

SOCIAL MEASURES.

In a major campaign of survey and mass treatment, such as is indicated above can be started and maintained, it should be possible to give a large proportion of the young, the rising generation, a start on their reproductive life uninfected. The greatest problem in the long run will be to induce the Murle so to re-orientate their behaviour pattern that there is a reasonable chance of their remaining uninfected. Full use of available facilities for early treatment is important but the main problem is social and will necessitate the cooperation of many people not obviously connected with medicine, including tribal leaders, administrative officers, agriculturalists, educationists and others. *The concept of a combined operation is fundamental.*

The present writer is not qualified to advise on the best approach to this part of the problem. The following ideas are set down only as possible starting points for expert consideration.

Would the Murle Chiefs and Elders consider imposing a really deterrent, but lawful, penalty for adultery, for instance a heavy fine of cows ?

Would husbands enforce it, if they realised that an unfaithful wife, far from getting a child, is likely to get a disease that may destroy her chance of ever having children ?

How can the time and energy of the warrior age-sets be usefully canalised, without destroying altogether the bonds of age-set brotherhood and removing all their pride and ambition ?

Would earlier marriage tend to lessen promiscuity, if it could be encouraged ?

It seems possible that an increase in the amount of cultivation might have beneficial effects in several ways. It would tend to 'settle' a large proportion of the population and make them accessible to all kinds of improved services especially *educational* and medical. And it generally seems that settled cultivators tend to establish a more stable social order, based on the family unit, than do nomadic herdsman (unless impelled by strong religious motives). The idea of tilling the soil is closely connected in men's minds with the idea of founding a permanent home and "setting down," figuratively as well as liberally. A comparison with the settled Boma Murle might be very instructive in this connection. And it is not impossible that the development of new crops and the improvement of the present very scanty ones might add to the wealth of the tribe and hence raise its standard of living.

EXPERT AND MATERIAL ASSISTANCE.

In conclusion I would like to stress the opinion, that if the problem of Murle infertility is to be tackled at all, it must be tackled with all the 'big guns' that can reasonably be brought to bear. *Any Scheme, once started, must not fail.* An attack on too limited a front or with insufficient resources would court failure, waste time and money, and possibly leave the Murle worse off than they were to begin with. I feel, with all possible respect, that for the project to have a really good chance of success, help will be needed from outside the Province and very possibly from outside the Sudan. In particular, we need the expert help of two specialists ; (1) a *venereologist*, experienced in survey and mass treatment work in the *tropics*, and (2) a *special psychologist or socioanthropologist*, experienced in assessing the attitudes and predicting the reactions of primitive peoples. Their cooperation is needed not only in the field but from the earliest stage of planning. It is probable, also, that at some stage expert advice and assistance will be required in the fields of Agriculture, Education, Trade, and others.

Experts such as are specially needed (1 and 2 above) are few and far between. It might be felt by the Authorities that those in one or both specialities available in the Sudan could ill be spared from their normal duties. If this should be so there is a considerable probability that, should it be considered appropriate to ask for it, help of this kind would be forthcoming from W.H.O. or one of the other International Agencies, or from one of the University Departments (e.g. of Social Studies) that are known to have special interests in tropical Africa. Moreover it is possible that W.H.O. might be able to provide other material help in the form of equipment, drugs or investigation facilities, and even, conceivably, some form of financial help.

For the rest, the staff of the American Mission at Pibor have promised to cooperate, and I feel sure that I can safely say that the University College of Khartoum would give any help particularly in the way of personnel—or offer any facilities that are within its power.

PRELIMINARY REPORT ON DEARTH OF CHILDREN AMONG : THE AZANDE

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INTRODUCTION.

For at least the past 25 years officials and other observers living in the Zande area have noticed and commented on an apparent dearth of children among the people of that Tribe. The Azande themselves appear to have been and to be aware of this. The phenomenon became known as "Zande Infertility."

The object of this survey was to discover if the available figures confirmed this impression and to review the possible aetiological factors at work.

The Azande (singular Zande) occupy an area of Central Africa of considerable extent. Part of this area is in the Anglo-Egyptian Sudan, part in French Equatorial Africa and part in the Belgian Congo. The section of the Tribe with which this paper is concerned inhabits the Ezo Sub-District of Equatoria Province of the Anglo-Egyptian Sudan (see sketch maps I and II). The area is administered from sub-district headquarters at Ezo and is under the medical charge of Sources Yubu Hospital (Sleeping Sickness Settlement).

The area is one in which Trypanosomiasis is endemic and among the measures adopted to control the disease are :—

- (1) Registration of all inhabitants, of movement within the area, of immigration to the area and emigration from it.
- (2) Medical inspection of all inhabitants at regular intervals, the registration documents being used to check that no one is missed and absentees found being put in a short period of "quarantine."
- (3) Compulsory resettlement of the population in "Lines" (see Note I, "Gbaria Lines"). Although the present form of resettlement is primarily an agricultural measure, the original resettlement of the people along roads was for the purpose of Sleeping Sickness control.

SUDAN NOTES AND RECORDS.

The strict control exercised makes this a particularly suitable area from which to obtain statistical information. There are, however, certain limitations. For instance, it is impossible to obtain an accurate Crude Live Birth Rate or Death Rate by direct and simple methods since only those infants who have been born and who have survived long enough to be seen at the following inspection are accurately recorded. Those who are born and who die before the next inspection are practically never recorded among either the births or deaths, and still births are never registered.

During the past 30 years constant change has been the lot of the Zande, both tribally and personally. Formerly a forest dweller, living in scattered homesteads as far as convenient from his neighbour, he was first shifted to the land bordering the roads and later to carefully mapped out "Lines." He is compulsorily medically inspected, and his agricultural activities are carefully supervised. He is a carefully preserved and protected individual but a much supervised man.

The origin of the Tribe is obscure. They are believed to have come from the West, conquering and absorbing their victims as they came. Larken, P.M. (Account of the Azande, 1926) writes :—

“ Pure Zandes are comparatively few and are out-numbered by the aboriginesthe original inhabitants have been so ready to assimilate the customs and language of their conquerors that for a rough survey no differentiation between victors and vanquished need be made.”

They were a highly successful martial race until defeated at the Battle of Tembura in 1905 by the Government troops, but their present appearance accords ill with their former martial reputation.

The impression one gets of the sexual morals of the Azande inspires wonder rather than horror. Both male and female appear to have a voracious appetite. This does not seem to be a recent development since in his account of the Azande Larken noted a certain “ lightness ” at least among the women.

“ He (the Zande) is not a village dwellerthe reason being the fear of magic and jealousy with regard to his women folkmoreover the ladies of the land not being remarkable for their fidelity are received oftemptation when a mile of forest separates them frompotential lovers.”

The society is a polygamous one and apart from marriage temporary liaisons are common. No stigma attaches to illegitimacy nor does the previous production of a bastard prejudice the women’s chance of future marriage. Illegitimacy is however, comparatively rare.

DEARTH OF CHILDREN AMONG THE AZANDE.

Among the general population the estimated number of wives per man was 1.2. In a sample of 336 householders it was also found to be 1.2, distributed as under :—

One wife	...	...	...	...	...	...	48%
Two wives	...	...	...	...	...	...	12%
Three wives	...	...	...	...	...	...	5%
Four wives	...	...	...	...	...	...	4%
Five wives or more	...	...	...	...	...	...	2%
No wives	...	...	...	...	...	...	29%

If “ batchelors ” were excluded from consideration, the distribution was :—

One wife	...	...	...	...	...	...	68%
Two wives	...	...	...	...	...	...	17%
Three wives	...	...	...	...	...	...	7%
Four wives	...	...	...	...	...	...	6%
Five or more wives	...	...	...	...	...	...	2%

In this same sample it was found that of these wives 31 per cent. believed themselves past the menopause, 58 per cent between the age of 15 and the menopause and 11 per cent were under 15 years.

Apart from a very few dwarfs, lepers and mentally afflicted, spinster-hood is practically unknown.

Sexual experience begins at an early, age, 10-12 years, and the Azande themselves admit the practical impossibility of marrying a virgin. Virginity is neither highly prized nor greatly protected and, although lip service is paid to its desirability in one's sister or daughter, neither parents, brothers nor the girls themselves appear to take any but the most perfunctory steps to preserve it.

POPULATION STATISTICS.

TABLE I.

	1949	1950	1951	Sources Yubu 1952
Total Azande Population	37,356	38461	50,299	1,081
Adult Male	11,929	12,582	15,793	382
Adult Female	14,872	15,991	20,122	514
Child Male	—	—	7,054	96
Child Female	—	—	7,330	81
Total Children... ..	10,555	9,888	14,384	185
Adult Sex Ratio	80	79	78	74
Child Sex Ratio	—	—	96	118
Number of Children per Adult				
Female	0.71	0.62	0.71	0.36
Child/Adult Ratio	1/2.7	1/2.9	1/2.5	1/4.8

8 infants of undermined sex.

SUDAN NOTES AND RECORDS.

These figures show a population pattern which is fairly uniform (see Table III). It is not, however, a normal one. The increase in population is apparent and not real. It is due to the fact that each year a greater part of the area has been re-settled and the population registered. By 1951 the whole area with minor exceptions such as the Missions had been resettled and registered. The population pattern for Sources Yubu differs from the other three in having a higher proportion of adults and a lower proportion of children. This, however, can be accounted for by a difference in definition. In the figures for the Azande population in Table I for the years 1949, 1950 and 1951 the term “ children ” means “ all offspring of the householders still living with their parents.” In the case of girls this means until they go to their husband's house which may not be till 17 years, and in the case of boys until they have a separate household which may not take place till 18-20 years in some cases. In the figures for Sources Yubu the ages were carefully assessed and only those under 15 years were included in the term “ children.”

Table II opposite shows a comparison between the population figures, for the Azande, for 1951 with those for Egypt for 1937 and England and Wales for 1948 the last two calculated from figures given in the United Nations Demographic Year Book 1949-50. From these it would appear that the Azande hold an intermediate

position between an Egyptian population which was increasing and an English one which was only slightly increasing. The population pattern shown in Table III. also indicates this intermediate position of the Azande population.

TABLE III.

	1949	1950	1951	Sources Yubu 1952	Egypt	U.K. 1948
Proportion of Adult male	32%	33%	32%	35%	30%	38%
Proportion of Adult Female	40%	41%	40%	37%	31%	41%
Proportion of Children	28%	26%	28%	18%	39%	21%

The abnormalities in this population pattern are sufficiently striking,

- (1) A marked female preponderance.
- (2) A low child/adult ratio.

Female preponderance.

This could be accounted for in a number of ways.

TABLE II.

Age Groups	EGYPT—1937			AZANDE—1951			U.K. (ENGLAND AND WALES) 1948		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
All Ages	15,920,694 — 100%	7,966,675 — 100%	7,954,019 — 100%	30,290 —100%	22,847 —100%	27,443 —100%	43,502,000 — 100%	21,091,000 — 100%	22,411,000 — 100%
0 — 15 years	6,225,514 — 39%	3,160,728 — 40%	3,064,786 — 39%	14,375 —29%	7,054 —31%	7,321 —27%	9,324,000 — 21%	4,760,000 — 23%	4,564,000 — 20%
Adults (15 plus years) ...	9,695,180 — 61%	4,805,947 — 60%	4,889,233 — 61%	35,915 —71%	15,793 —69%	20,122 —79%	34,178,000 — 79%	16,331,000 — 77%	17,847,000 — 80%
Sex Ratio Adult		100			78			94	
Sex Ratio Child		103			96			104	
No. of Children per adult female		1.3			0.71			0.52	
Child/Adult Ratio		1/1.6			1/2.5			1/3.7	

DEARTH OF CHILDREN AMONG THE AZANDE.

(a) *Inaccuracy of the Figures.*

There are good reasons for believing these figures to be accurate. In the first place they compare well with each other over these three years. Secondly, having been compiled for three separate purposes, namely Sleeping Sickness Control, Taxation and Agricultural Control, it would seem unlikely that three separate departmental organisations could be deceived in exactly the same way over the same period.

(b) *A Markedly Higher Mortality Rate Among Men Than Among Women.*

There are no figures available from among the general population but it does not seem to be true for the hospital population. In the year 1951/52 there were 3,407 admissions to hospital, of whom 46 died, giving a death rate of 13.5 per 1,000. Of these 1,654 were men and of these 31 died, giving a death rate of 19 per 1,000. Of the 1,267 women admitted 14 died, giving a death rate of 11 per 1,000. The remainder, 486, were children, and of these 1 died, a death rate of 2 per 1,000.

(c) *Immigration by Women of Other Tribes.*

Again no figures are available. The one other tribe adjacent to this part of the Azande area, the Balanda, is locally reputed to produce more fertile women and some intermarriage certainly occurs. (See Note II.)

(d) *Emigration of Men.*

All such movement is recorded and does not seem to take place to any great extent.

(e) *Greater proportion of Females at Birth than is Usual.*

No figures are available.

None of these factors, by itself, provides an adequate explanation of this phenomenon and if immigration of women of other tribes is occurring on a greater scale than is believed, the local fertility can hardly be founded on fact.

Low Child/Adult Ratio.

This is even lower than the figures in Table I. would suggest for the reasons given on page 8. Several factors might be at work to produce this low figure :—

- (1) A high proportion of infertile marriages.
- (2) A low Live Birth Rate : i.e. normal fertility with a high proportion of conceptions ending in abortion or still birth.
- (3) A high Infant and/or Child Mortality Rate.

SUDAN NOTES AND RECORDS.

Reproduction Rate.

The ages of the population of Sources Yubu having been assessed, the reproduction rate was calculated by the method suggested in the United Nations Demographic Year Book for 1949-50.

$$\begin{aligned} \text{Reproduction Rate} &= \frac{\text{Number of children under 5 years.}}{\text{Number of women 15-49 years.}} \\ &= \frac{426}{183} \times 1000 \end{aligned}$$

This is an extremely low figure since for a population maintaining but not increasing its numbers the figure should be in the region of 300. The numbers involved in this particular calculation were, however, very small.

OBSTETRIC AND FAMILY HISTORIES.

Obstetric and family histories were taken from a number of Azande women. They were not selected in the respect that all lived within easy reach of Sources Yubu. Where this could be done with reasonable accuracy the ages were estimated. Unfortunately sufficient accuracy could be assured in only the minority of cases. These were then divided into three groups.

- (1) First half of reproductive life, i.e. 15-29 years.
- (2) Second half of reproductive life, 30-45 years.
- (3) Those whose menstruation had ceased and whose ages were estimated to be over 45 years.

Table IV. shows the results obtained for these three groups and compares them with results obtained for the whole series.

DEARTH OF CHILDREN AMONG THE AZANDE.

TABLE IV.

	First Half Reprodu- ctive Life	Second Half Reprodu- ctive	Past Reprodu- ctive	Whole Series
Number of Women	187	163	52	10,034
Number of Nulliparae	113-60%	67-41%	5-10%	458-44%
Number of Pregnancies	107	277	221	1,917
Average Number of Pregnancies per Woman	0.6	1.7	4.3	1.8
Average Number of Pregnancies per Parous Woman	1.4	2.8	4.7	3.3
Number of Abortions (% Pregnancies)	11-10%	35-13%	11-5%	108-6%
Number of Stillbirths (% Pregnancies)	6-5.6%	10-3.6%	4-2%	85-4%
Number of Stillbirths per 1000 Live Births	66	43	19	50
Proportion of Pregnancies ending in Stillbirth of Abortion... ..	15.6%	16.6%	7%	10%
Number of Infant Deaths per 1000 Live Births	168	151	139	—
Number of Child Deaths per 100 Live Births	19	78	125	—
Number of Infant and Child Deaths	187	229	264	317

Owing to the smallness of the numbers in whom age was determined, comparison between the three groups can hardly be expected to give significant results. Such as they are these figures would appear to suggest that :—

- (a) The number of nulliparae in the first two groups is high. With regard to the first group it has been noticed that many girls marrying in their teens fail to produce their first child until their early twenties. This was commented upon by Larken (Account of the Azande), who says :—

“ The man is fertile at this age (17 years), the girl usually is not and ordinary she will not become a mother until 23-24.”

- (b) The abortion rate is not unduly high since this in European societies has been variously estimated as between 10 per cent and 20 per cent.
- (c) The stillbirth rate is high but not outstandingly so when one considers the remoteness of most of the population from antenatal care or even in many cases from medical aid. Practically all confinements are conducted by native “ midwives ” whose function is as much magical as obstetric.
- (d) The number of infant and child deaths per 100 live births is high.

Considering the figures for the whole series the most striking things are :—

- (1) The high nulliparous rate.
- (2) The high infant and child mortality rate.

SUDAN NOTES AND RECORDS.

AETIOLOGICAL CONSIDERATION.

1. Venereal Disease.

It is difficult to assess the incidence of venereal disease in the population. Records, naturally, show only the number of cases treated and, at least in the case of syphilis, these records are inaccurate, since the diagnosis of syphilis made by Medical Assistants in dispensaries cannot be relied on, any type of skin condition, not absolutely typical of scabies, taenia or leprosy, being considered sufficient justification of a course of N.A.B. and Bisoxyl. The diagnosis is also popular, and is often made by the patient, to account for vague aches and pains in later life much in the way that “ rheumatism ” is invoked in more temperate regions. The diagnosis of gonorrhoea is more accurate and is in the majority of cases made microscopically.

In Table V the figures for venereal disease in Sources Yubu are given. These are likely to give a more accurate picture of the situation than those for the general population because of proximity to and intimate association with the hospital (every male and some females are employed by the hospital authorities and their families are well known to these authorities), and because diagnosis are likely to be more accurate.

TABLE V.

Population 1951	% Treated for any Form of V.D.	% Treated for Syphilis	% Treated for Gonorrhoea
Adult Male—410 	14%	1.5%	12.5%
Adult Female-485 	10%	4%	6%
Total Adult-895 	12%	3%	9%
Children-219 	2.3%	1.3%	1%

These figures indicate that there is a high incidence of these diseases but not high enough to be implicated as the sole aetiological factor in reduction of population. Congential syphilis and ophthalmia neonatorum are not common and only one case of acute salpingitis has been seen in a year.

DEARTH OF CHILDREN AMONG THE AZANDE.

2. Leprosy.

The incidence is high. There are 3,443 registered lepers from among the Zande population of the area, of whom 1,478 are male and 1,966 are female, a sex incidence of 1/1.3 These registered lepers constitute 6.6 per cent of the Azande population and new cases are constantly being discovered. The classification of these cases is as follows :—

Neural	...	...	...	...	...	...	...	68%
Lepromatous	...	...	...	...	...	...	...	14%
Mixed	...	...	...	...	...	...	...	5%
Unclassified	...	...	...	...	...	...	...	13%

Leprosy can cause infertility but it is only believed to do so in the male in advanced lepromatous cases in which the testicles are involved. Here lepromatous cases are in minority and none have been seen with obvious testicular involvement. The incidence among these cases is, also greater in the female than the male. The majority of cases are mild and show a considerable degree of resistance.

In “ Leprosy ” by Sir Leonard Rogers and E. Muir, the authors write :—

“ decreased fertility as a whole is, therefore, of minor importance except in advanced lepromatous cases in males.”

However, according to Hansen, quoted in the same work, the testicles are involved in all nodular cases and other workers have found that the birth rate among lepers is about 2/3 that in non-leper communities.

Taking into consideration the mildness of the disease in this district, the high degree of resistance indicated by the proportion of neural cases and the sex incidence it seems unlikely that this condition, despite the probability of there being many undiscovered cases, is a significant factor in reduction of population.

3. Sleeping Sickness.

No new cases of Trypanosomiasis have been discovered in the past year and the numbers have been markedly decreasing in previous years. 48 old cases remain under observation or treatment.

In the adjacent part of the Azande area, administered medically by Li Rangu Sleeping Sickness Settlement, new cases are being discovered in some number and a difference, believed significant, has been shown between the child/adult ratio in that part of the area where new cases are being found and the part in which none have been found. In the former this ratio is 1/2.9 and in the latter 1/4.3 (Li Rangu Annual Report 1951/1952).

SUDAN NOTES AND RECORDS.

It has been suggested that Sleeping Sickness may result in reduction of fertility and also that “ suramin ” used in treatment may have the same effect. The incidence of the disease, however, does not seem sufficiently high for these effects to be widespread.

4. Endemic Goitre.

Goitre is endemic in the area and the position regarding it has been clearly stated by Woodman in his recent paper on the subject. Up to 3 per cent of the population are affected and 85 per cent of cases are women. True cretinism is, however, unknown.

5. Nutrition.

A detailed nutritional survey was conducted by Mrs. G. M. Culwick in 1950. The main conclusions she reached were :—

- (1) The quantity of food is geared to a slow rate of living with a low output of energy.
- (2) The protein/carbohydrate ratio is low.
- (3) There is some deficiency of riboflavine.

With regard to the first of these conclusions, the rate of living does not seem to be particularly slow. The Azande are far from being hard workers but most have a long working day and can nevertheless dance energetically all night. No more than a guess can be made at the accuracy of this conclusion since no figures for Basal Metabolic Rates are available. Clinical malnutrition is an extreme rarity and severe anaemia, in the absence of Bilharzia or Ankylostoma, has not been seen nor have cases of riboflavine deficiency been seen.

6. Voluntary Contraception.

Whether or not this occurs to any extent is not known. It is, however, noticeable that the men show a more marked concern about inability to have children than the women and some at least firmly believe that in some mysterious and possibly magical way a wife can revenge herself in an unsatisfactory husband by preventing conception.

7. Malaria.

Although Malignant Tertian Malaria is a fairly common disease it does not seem to play an important part in the production of abortion or in raising the death rate, at least as far as can be inferred from hospital statistics. In 1951/52 there were 205 cases of Malaria out of a total of 24,949 new cases i.e. 0.8 per cent. Of these 71 were admitted to Hospital out of a total of 3,407 admissions i.e. 2.1 %. There were no deaths. Of these 205 cases 184 were Malignant Tertian, 3 were Benign Tertian and 18 were clinical.

CONCLUSION.

Before drawing any conclusions it is necessary to consider the limitations of the material presented.

While the figures given in the first section "Population Statistics" are considered to be accurate, those under the sub-heading "Reproduction Rate" are taken from such a small section of the population that conclusions cannot be drawn from them. In the section "Obstetric and Family Histories" the numbers divided into age groups are again too small for conclusions to be drawn, and under "Aetiological Considerations" the difficulties of obtaining accurate figures for the incidence of Venereal Disease have been sufficiently stressed.

It is, however, concluded that :—

- (1) There is a low Child/Adult Ratio.
- (2) There is a marked female preponderance.
- (3) There is a high infant and Child Mortality Rate.
- (4) Though not so prolific as in the past it is probable that the people are managing to reproduce themselves.

None of the aetiological factors reviewed are in themselves sufficient to account for a lowering in reproduction rate and a great deal more work will be necessary to determine accurately the incidence of Venereal Disease and the incidence of Tubal Occlusion among women.

It is heartening, however, to reflect that these figures here presented for what they are worth do not paint a picture of quite such unrelieved gloom as might have been expected from previous rumour and report.

NOTE I.

THE BALANDA.

This tribe, once conquered by the Azande, inhabits the area adjacent to and to the north of the part of the Azande with which this paper deals.

Their conditions of life are similar, they are subject to the same form of administration, and they have been moved and resettled in the same way. They are to a very great extent “ Zandeised.” The endemic diseases to which they are exposed are the same and they are subject to the same rules of medical inspection.

They are believed by the Azande to be more fertile and inter-marriage takes place but the extent to which it does so is not known accurately.

The figures given in Table VI. show that the Child/Adult Ratio is higher than that of the Azande but it is still a low one. In Table VIII they are compared. The Balanda population pattern for these years is not so uniform as that of the Azande, the main variation being in the male population and the proportion of females remaining fairly constant.

TABLE VI.

	1949	1950	1951
Total Population	16,168	17,390	16,750
Adult Male	4,244	4,830	5,300
Adult Female	5,596	5,816	5,510
Child Male	—	—	2,814
Child Female	—	—	2,946
Total Children	6,328	6,744	5,760
Adult Sex Ratio	76	83	96
Child Sex Ratio	—	—	95
Number of Children per Adult Female	1.13	1.15	1.04
Child/Adult Ratio	1/1.55	1/1.57	1/1.87

TABLE VII.

	1949	1950	1951
Adult Male	27 %	27 %	32 %
Adult Female	34 %	34 %	33 %
Children	39 %	39 %	35 %

TABLE VIII.

YEAR	Azande	Balanda
1949	1/2.7	1/1.55
1950	1/2.9	1/1.57
1951	1/2.5	1/1.87

NOTE II.

“GBARIA” LINES.

These are linear plots of land each of the same size marching with each other, the row or “line” of plots being placed normally at right angles to the road. Each plot is held in the name of one householder and on it he lives and cultivates.

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CHAPTER X.

METEOROLOGY.

Table XXVIII. shows the mean of the rainfall recorded in provincial meteorological stations :—

TABLE XXVIII.

PROVINCE	No. of Stations	Mean Rainfall mms.	Highest Recorded mms.	Lowest Recorded mms.
Bahr El Ghazal 	10	1,023	1,372	478
Blue Nile 	15	481	960	259
Darfur	7	614	835	399
Equatoria 	10	1,115	1,634	694
Kassala 	13	156	587	15
Khartoum 	6	247	377	170
Kordofan 	10	604	867	306
Northern 	9	50	119	3
Upper Nile 	10	898	1,565	730

TABLE I.
OUT-PATIENTS.
NEW CASES BY DISEASES AND TOTAL ATTENDANCES.

DISEASE	B-EL-GHAZAL	BLUE NILE	DARFUR	EQUATORIA	KASSALA	KHARTOUM	KORDOFAN	NORTHERN	UPPER NILE	TOTAL	
1. Cholera ...	—	—	—	—	—	—	—	—	—	—	1
2. Plague ...	—	—	—	—	—	—	—	—	—	—	2
3. Smallpox ...	3,307	—	653	226	—	1	11	—	2	4,200	3
4. Typhus ...	—	—	—	—	—	—	—	—	—	—	4
5. Yellow Fever ...	—	—	—	—	—	—	—	—	—	—	5
6. T.B. Pulmonary	215	555	132	260	684	740	347	428	196	196	6
7. T.B. Non-Pulmonary ...	21	278	108	59	374	380	193	337	196	1,946	7
8. Pneumonia ...	1,457	10,968	2,392	2,976	2,546	5,696	6,200	4,471	2,275	38,981	8
9. Influenza ...	96	1,306	2,448	797	1,535	7,098	3,033	7555	—	23,868	9
10. Other Respiratory diseases ...	30,818	213,861	46,876	111,916	111,723	135,316	120,034	100,051	43,350	913,935	10
11. Cerebrospinal Meningitis ...	2,142	103	318	23	53	56	153	23	599	3,470	11
12. Chicken-Pox ...	324	1,414	306	2,545	559	1,149	1,474	1,027	1,190	9,988	12
13. Diphtheria ...	1	102	8	11	39	124	29	49	6	369	13
14. Encephalitis	—	—	—	402	—	1	—	—	—	403	14
15. Lethargica ...	153	1,060	156	3,267	326	1,523	960	894	316	8,655	15
16. Mumps ...	490	1,183	646	2,001	1,194	1,986	1,212	1,845	322	10,879	16
17. Poliomyelitis, acute	—	—	1	—	10	61	26	1	—	403	17
18. Rheumatism, acute	1,511	3,073	182	1,097	183	1,835	740	1,160	939	10,720	18
19. Whooping Cough	—	1,985	182	388	1,147	1,843	730	2,030	685	8,990	19
20. Dysentery ...	6,049	16,995	5,263	3,406	4,975	13,030	10,034	10,304	5,764	75,820	20
21. Enteric Fever ...	86	137	5	1	76	57	13	170	3	548	21
22. Gastro-enteritis of children	—	24,041	2,922	136	1,922	17,677	3,798	8,314	1,647	62,457	22
23. Undulant Fever	—	16	1	1	20	5	1	3	—	47	23
24. Filariasis ...	352	3	16	632	—	3	9	—	—	1,015	24
25. Leishmaniasis ...	—	546	20	46	282	15	4	3	190	1,106	25
26. Malaria ...	12,952	105,589	45,927	56,617	44,586	16,001	113,105	16,017	28,492	439,286	26
27. Blackwater Fever	—	2	—	—	—	—	6	—	—	8	27
28. Onchocerciasis ...	31	—	—	15	—	3	—	—	—	49	28
29. Phlebotomus Fever	—	—	—	—	—	2	3	87	—	922	29
30. Relapsing Fever	—	—	—	—	—	3	—	—	—	3	30
31. Trypanosomiasis	—	—	—	—	—	—	—	—	—	561	31
32. Ancylostomiasis ...	1,783	35	154	5,813	22	64	7	99	51	8,028	32
33. Dracontiasis ...	3,599	165	2	2,453	274	67	570	5	67	7,202	33
34. Schistosomiasis ...	821	11,468	3,240	3,528	468	2,539	9,972	5,314	220	37,570	34
35. Gonorrhoea ...	2,891	679	4,776	3,894	3,629	4,794	7,123	1,001	2,509	37,408	35
36. Soft Sore	143	337	1,106	450	675	553	316	15	22	3,617	36
37. Syphilis ...	6,954	16,889	30,325	6,522	10,440	7,453	28,160	4,167	14,673	125,583	37
38. Yaws ...	290,197	3	29	16,506	—	2	42	—	9,803	316,582	38
39. Anthrax ...	—	8	7	—	1	3	1	—	33	53	39
40. Hydrophobia, Human	—	2	—	3	—	—	7	—	—	12	40
41. Leprosy ...	105	42	94	715	11	40	35	30	34	1,106	41
42. Madura ...	—	264	30	1	29	218	39	34	2	617	42
43. Tetanus	24	50	8	17	46	17	13	16	12	203	43
44. Heat Stroke Syndrome	—	—	—	1	28	10	6	4	—	49	44
45. Confinements ...	262	518	193	329	660	830	469	177	33	3,471	45
46. Gynaecological ...	109	11,755	1,532	157	3,311	7,684	8,247	1,848	174	34,817	46
47. Diseases of Pregnancy and Parturition ...	6	236	131	169	139	1,539	2,653	100	—	4,973	47
48. Puerperal Fever...	1	43	23	1	29	190	39	68	78	472	48
49. Wounds and Injuries	55,735	254,015	105,005	157,351	129,034	132,604	145,322	98,400	60,352	1,137,818	49
50. Tropical Ulcer ...	10,705	2,371	2,670	13,395	564	444	5,266	5	5,314	40,734	50
51. Diabetes	—	171	36	1	220	906	304	515	1	2,154	51
52. Pellagra ...	—	3	2	1	—	1	—	1	—	8	52
53. Scurvy ...	3	75	15	32	177	49	352	6	19	728	53
54. Neoplasms, Malignant	19	22	843	30	27	108	95	65	13	1,222	54
55. Neoplasms, non-malignant	342	3,558	720	74	631	1,064	994	362	241	7,986	55
56. Trachoma	78	35,682	7,211	914	9,123	35,848	11,151	48,539	3,560	152,106	56
57. All other eye disease	26,349	226,731	47,501	52,421	72,063	122,583	86,883	95,250	47,430	777,211	57
58. Ear disease	5,303	49,552	13,988	10,849	20,450	17,152	19,223	20,917	8,723	166,157	58
59. Skin diseases	61,265	29,416	22,229	40,621	9,412	13,211	22,893	15,952	11,054	226,053	59
60. Alimentary diseases	44,084	314,556	80,083	95,648	107,416	172,328	170,237	149,327	42,714	1,176,393	60
61. Circulatory diseases	441	13,348	5,608	72	17,186	14,143	10,897	13,414	144	75,353	61
62. Gento-Urinary diseases	666	39,994	27,071	1,242	10,377	15,773	18,917	21,139	1,801	136,980	62
63. Organic Nervous diseases	3	2,810	5,371	38	89	1,512	3,467	5,123	258	18,671	63
64. Functional Nervous diseases	298	745	51	20	2,324	580	26	506	—	4,550	64
65. Fever of uncertain origin...	11,850	26,311	260	28,606	18,833	68,658	13,271	24,335	38,698	230,822	65
66. All other conditions	83,537	246,519	44,135	85,479	77,529	105,679	109,223	78,263	39,452	869,599	66
67. Poisoning...	—	143	44	19	72	12	91	632	—	1,013	67
68. Erysipelas	—	—	—	—	2	—	—	2	—	4	68
69. Dengue ...	—	—	—	—	—	—	—	43	—	43	69
Total New Cases	667,578	1,677,845	513,055	714,755	667,515	935,263	938,426	740,443	373,757	7,228,637	
ATTENDANCES : MEN ...	971,441	1,329,275	440,794	523,307	577,073	873,667	753,021	556,163	284,694	6,309,435	
WOMEN ...	41,952	940,649	346,247	324,689	273,364	718,111	602,070	550,390	200,139	3,997,611	
CHILDREN ...	43,959	1,531,946	447,809	379,049	525,222	778,035	806,135	1,030,310	258,382	5,800,847	
Total Attendances	1,057,352	3,801,870	1,234,850	1,227,045	1,375,659	2,369,813	1,161,226	2,136,863	743,215	16,107,893	
MISSIONS ...	—	—	—	170,842	—	55,754	67,412	—	51,994	346,002	
Grand Total ...	1,057,352	3,801,870	1,234,850	1,397,887	1,375,659	2,425,567	2,228,638	2,136,863	795,209	16,453,895	

TABLE 11.

ADMISSIONS AND DEATHS BY DISEASES.

DISEASE	BAHR-EL-GHAZAL		BLUE NILE		DARFUR		EQUATORIA		KASSALA		KHARTOUM		KORDOFAN		NORTHERN		UPPER NILE		TOTAL	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
1. Cholera	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
2. Plague	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
3. Smallpox	3,307	461	—	—	653	109	226	10	—	—	1	—	11	4	—	—	2	—	4,200	584
4. Typhus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
5. Yellow Fever	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5
6. T.B. Pulmonary	193	27	425	35	93	18	140	26	554	49	826	22	281	36	250	11	106	7	2,868	231
7. T.B. Non-Pulmonary	21	3	118	10	38	5	38	1	188	7	137	5	134	4	177	2	64	7	915	44
8. Pneumonia	591	30	1,149	48	687	39	1,368	101	977	40	890	41	2,003	103	690	36	448	19	8,803	457
9. Influenza	8	—	53	—	40	—	194	4	53	—	176	2	42	—	36	—	17	—	619	6
10. Other Respiratory diseases	419	10	1,248	34	432	16	820	6	1,122	25	1,902	13	1,120	12	891	3	398	17	8,343	136
11. Cerebrospinal Meningitis	2,142	249	70	22	318	76	18	8	53	17	53	7	109	44	23	9	599	60	3,385	492
12. Chicken-Pox	272	16	180	—	121	1	897	3	110	4	85	—	943	—	49	—	432	—	3,089	24
13. Diphtheria	1	1	90	22	8	1	10	2	39	13	124	9	29	5	42	8	6	—	349	61
14. Encephalitis Lethargica	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	1	1
15. Measles	19	—	53	1	31	—	629	10	28	—	88	1	172	—	52	—	13	—	1,085	12
16. Mumps	80	—	59	—	70	—	61	1	58	—	50	1	213	—	18	—	40	—	649	2
17. Poliomyelitis, acute	—	—	—	—	—	—	—	—	10	—	1	—	2	—	1	—	—	—	14	—
18. Rheumatism, acute	165	1	143	1	26	—	62	—	68	—	90	—	101	—	112	—	17	—	784	2
19. Whooping Cough	—	—	47	2	1	—	67	1	16	—	86	4	41	—	17	—	15	—	299	8
20. Dysentery	465	19	426	15	491	11	589	15	414	3	467	6	371	13	346	4	440	18	4,009	104
21. Enteric Fever	2	1	137	2	5	—	1	—	74	15	57	7	13	2	170	7	1	—	460	34
22. Gastro-enteritis of children	6	2	378	33	34	—	121	17	115	10	481	44	160	19	225	43	112	6	1,632	174
23. Undulant Fever	—	—	16	—	1	—	1	—	20	—	5	—	1	—	3	—	—	—	47	—
24. Filariasis	7	—	3	—	2	—	77	2	1	—	3	—	5	—	3	—	3	—	104	2
25. Leishmaniasis	—	—	479	29	20	1	46	2	277	20	15	3	4	1	—	—	108	3	949	59
26. Malaria	1,074	33	2,509	38	822	18	4,523	135	2,211	29	612	10	3,546	61	496	—	510	13	16,303	337
27. Blackwater Fever	—	—	2	—	—	—	—	—	—	—	—	—	6	—	—	—	—	—	8	—
28. Onchocerciasis	6	—	—	—	—	—	—	—	—	—	3	—	—	—	2	—	—	—	11	—
29. Phlebotomus	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	—
30. Relapsing Fever	—	—	—	—	—	—	—	—	—	—	3	1	—	—	—	—	—	—	3	1
31. Trypanosomiasis	—	—	—	—	—	—	437	—	—	—	—	—	—	—	—	—	—	—	437	—
32. Ancylostomiasis	686	14	3	—	59	1	1,152	7	10	—	42	—	3	—	37	—	8	—	2,000	22
33. Dracontiasis	274	—	20	—	—	—	586	4	31	—	50	—	121	—	5	—	39	—	1,126	4
34. Schistosomiasis	171	—	379	19	66	1	653	2	95	1	119	—	68	—	115	—	5	—	1,671	23
35. Gonorrhoea	843	1	79	—	120	—	1,245	4	108	—	143	—	296	1	52	—	110	—	2,996	6
36. Soft Sore	8	—	9	—	38	1	450	1	50	—	13	—	21	—	1	—	5	—	595	2
37. Syphilis	1,111	5	174	2	1,097	9	999	—	115	1	132	—	747	4	114	—	857	—	5,346	21
38. Yaws	1,204	1	—	—	—	—	616	10	—	—	—	—	—	—	—	—	566	—	2,386	11
39. Anthrax	—	—	—	—	6	—	—	—	1	—	3	—	1	1	—	—	33	2	44	3
40. Hydrophobia, human	—	—	2	2	—	—	3	3	—	—	—	—	7	7	—	—	—	—	12	12
41. Leprosy	24	1	17	1	5	—	92	1	9	1	28	1	6	—	19	—	2	1	202	6
42. Madura Disease	—	—	110	—	12	—	1	—	18	—	102	—	47	1	79	—	—	—	369	1
43. Tetanus	22	9	49	14	8	—	16	11	17	13	17	6	9	3	16	2	7	1	161	59
44. Heat Stroke Syndrome	—	—	—	—	—	—	1	—	52	2	1	—	3	1	—	—	—	—	57	3
45. Confinements	262	3	504	8	98	2	308	10	177	4	209	9	412	15	180	4	13	—	2,344	55
46. Gynaecological	70	1	1,976	12	196	1	47	1	283	2	1,136	7	681	13	703	3	42	—	5,134	40
47. Diseases of Pregnancy and Parturition	4	—	80	1	41	1	133	2	99	2	589	4	171	2	92	4	—	—	1,209	16
48. Puerperal Fever	1	—	36	—	11	1	—	—	27	1	116	3	11	1	16	3	—	—	218	8
49. Wounds and Injuries	3,183	46	3,965	73	2,275	35	6,279	18	2,773	43	1,541	10	4,377	52	1,683	18	—	—	23,798	295
50. Tropical Ulcer	1,148	4	29	4	153	2	882	4	87	—	37	2	577	1	—	—	2,075	10	4,988	27
51. Diabetes	—	—	76	2	11	3	2	—	53	5	166	7	36	4	122	4	802	4	1,268	29
52. Pellagra	—	—	2	—	1	—	—	—	—	—	1	—	—	—	1	—	—	—	5	—
53. Scurvy	2	—	3	—	1	—	2	—	2	1	7	—	9	—	5	1	—	—	31	2
54. Neoplasms, Malignant	20	3	19	2	56	5	30	3	215	4	105	11	67	5	30	4	2	—	544	37
55. Neoplasms, non-malignant	80	1	60	—	70	—	47	1	151	3	124	—	46	2	37	—	11	—	626	7
56. Trachoma	2	—	11	—	17	—	287	—	59	—	25	—	18	—	87	—	13	1	519	1
57. All other eye diseases	529	—	223	2	162	1	395	1	214	2	893	—	289	—	553	—	132	—	3,390	7
58. Ear diseases	229	—	49	—	51	—	163	—	25	1	32	—	109	1	65	—	764	—	1,487	2
59. Skin diseases	395	—	215	—	140	—	567	—	62	—	200	—	222	—	131	—	46	—	1,978	8
60. Alimentary diseases	824	27	2,125	103	814	37	1,649	61	1,095	71	1,882	29	1,769	89	1,470	37	139	4	11,767	457
61. Circulatory diseases	34	15	463	57	289	22	156	12	713	39	647	30	436	50	570	45	429	7	3,737	277
62. Genito-Urinary diseases	14	—	722	26	382	9	56	4	572	34	471	5	686	33	574	19	164	7	3,641	137
63. Organic Nervous diseases	2	—	82	8	39	2	50	5	217	9	207	13	131	12	62	1	112	1	902	51
64. Functional Nervous diseases	38	5	20	—	4	1	24	—	—	—	31	3	6	—	43	1	14	3	180	13
65. Fever of uncertain origin	244	2	413	26	264	16	869	12	269	42	553	17	209	5	885	12	225	9	3,931	141
66. All other conditions	5,734	245	1,587	61	875	14	3,484	54	1,613	40	985	10	1,351	36	534	9	807	9	13,961	478
67. Poisoning	—	—	31	2	3	—	10	—	10	—	12	—	44	2	31	4	—	—	141	8
68. Erysipelas	—	—	—	—	—	—	—	—	2	1	—	—	—	—	—	—	—	—	2	1
Total	25,936	1,238	21,118	720	11,257	461	31,579	576	15,612	554	16,857	344	17,015	644	11,915	294	10,853	210	162,142	5,041
Missions	—	—	—	—	—	—	1,589	31	—	—	1,869	99	5,278	—	—	—	214	—	8,950	130
Grand Total	25,936	1,238	21,118	720	11,257	461	33,168	607	15,612	554	18,726	443	22,293	644	11,915	294	11,067	210	171,092	5,171

